

IV Year II Semester

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Code: 17EC841

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**INTRODUCTION TO DIGITAL IMAGE PROCESSING
(Open Elective-II)**

Course Objectives:

Students undergoing this course are expected to:

1. Familiarize with basic concepts of digital image processing and different image transforms
2. Learn various image processing techniques like image enhancement, restoration, segmentation and compression
3. Understand color fundamentals and different color models
4. Understand wavelets and morphological image processing

Course Outcomes:

After undergoing the course students will be able to

- Perform image manipulations and different digital image processing techniques
- Perform basic operations like – Enhancement, segmentation, compression, Image transforms and restoration techniques on image.
- Analyze pseudo and full color image processing techniques.
- Apply various morphological operators on images

UNIT-1

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.

Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.

UNIT-2

Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods

Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

UNIT-3

Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering ,geometric mean filter ,image reconstruction from projections.

UNIT-4

Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding

Wavelets and Multiresolution Processing: Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

UNIT-5

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation.

Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

UNIT-6

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

Text Books

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar,” Digital Image Processing”, Tata McGraw-Hill Education, 2011.

Reference Books

1. Anil K.Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2009.