IV B.Tech – I Semester (17EC731) DIGITAL IMAGE PROCESSING (Professional Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	Т	Р
40	60	100	3	1	-
Pre-Requisi	ites: Digital S	ignal Processing			

Course Objectives:

- To understand the need for different transform techniques useful for image processing applications. •
- To apply spatial and frequency domain filtering on image and implement smoothing and sharpening • operations on images
- To evaluate different methodologies used for image enhancement and restoration techniques on . images.
- To analyze the basic algorithms used for image processing & image compression. .
- To interpret image segmentation and representation techniques.
- To Categorize various color image processing models used in digital color images.

UNIT-I:

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-II:

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-III:

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-IV:

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 Multi resolution Processing: Image pyramids, sub band coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

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UNIT-V:

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-VI:

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.

Course Outcomes:

After successful completion of the course, the students can be able to:

S. No	Course Outcome					
1.	Understand the need for different transform techniques useful for image processing	L2				
	applications.					
2.	Apply spatial and frequency domain filtering on image and implement smoothing and	L3				
	sharpening operations on images					
3.	Evaluate different methodologies used for image enhancement and restoration	L5				
	operations/techniques on images					
4.	Analyze the basic algorithms used for image processing & image compression	L4				
5.	Interpret image segmentation and representation techniques	L2				
6.	Categorize various color image processing models used in digital color images	L4				

Correlation of COs with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	2	1	1	-	1	1	-	1	3	3
CO 2	3	3	2	1	2	2	1	-	1	1	-	-	3	3
CO 3	3	2	3	1	2	2	1	-	1	1	-	-	3	2
CO 4	3	2	3	1	2	2	1	-	1	1	-	-	3	2
CO 5	3	2	1	1	1	1	-	-	1	1	-	-	3	2
CO 6	3	2	1	1	1	1	1	-	1	1	-	-	3	2

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.