Digital Image Processing EC662

Course code	Course title	Credits			Total Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 662	Digital Image Processing	3	0	0	3	50	50	100

Course outcome: At the end of the course, the student should be able

1. Demonstrate the knowledge on Digital image fundamentals and Image enhancement techniques in spatial and frequency domain.
2. Apply basic morphological and Segmentation algorithms for digital image processing.
3. Understand the various color models analyze and apply them for color image processing
4. Evaluate the various image compression techniques and its applications.
5. Demonstrate critical thinking by exploring recent trends in image processing and implementing various image processing algorithms.

UNIT 1:

Digital Image Fundamentals: Elements of visual perception, Image sensing and acquisition, Image sampling and quantization, 2D sampling theorem, spatial and intensity resolution, Image interpolation and resampling, Basic relationships between pixels.

Image Enhancement in Spatial Domain: Basic gray level transformations, histogram processing, histogram equalization, histogram matching, enhancement using histogram statistics, image subtraction, averaging, smoothing and sharpening using spatial filters and their combination.

08 Hours

UNIT 2:

Image Enhancement in Frequency Domain: The2D Discrete Fourier Transform and its inverse, some properties of the 2D DFT, FFT and IFFT in 2D, Frequency domain filtering fundamentals, Correspondence between filtering in spatial and frequency domain, smoothing and sharpening using Butterworth and Guassian Lowpass and High pass filters, The Laplacian in the frequency domain, Unsharp masking, High boost filtering, High frequency emphasis filtering, Homomorphic filtering. **08 Hours**

UNIT 3:

Basic Morphological Algorithms: Dilation and erosion, Opening and closing, The Hit or Miss transformation, Boundary extraction, Region filling, Extraction of connected components, Convex Hull, Thinning, Thickening and Pruning. **08 Hours**

UNIT 4:

Color image processing: Color models RGB, CMY, CMYK, HSI, Color transformations, Converting colors from RGB to HSI and HSI to RGB, Pseudo color image processing

Image segmentation: Point, line and edge detection (Robert, Canny and Prewitt techniques), Thresholding, Basic global thresholding, optimum global thresholding using Otsu's method.

08 Hours

UNIT 5

Image Compression: Fundamentals, some basic compression methods- Huffman, Arithmetic and LZW coding techniques, Fractal image Compression, Digital image watermarking. **08 Hours**

Self-Learning Components: Recent trends and Case studies: Pattern recognition problems from recent journal publications.

Text Books:

1. **Rafael C. Gonzalez & Richard E. Woods:** "*Digital Image Processing***"**, 4th edition, Pearson Prentice Hall, 2018
2. **Anil K. Jain**, "*Fundamentals of Digital Image Processing***"**, Prentice Hall India, 2016.
3. **John C Russ**, "*The Image Processing Handbook"*, 5th edition, CRC Press, 2006.

4. **Maria Petrou and Costas Petrou**, "*Image Processing: The Fundamentals***"**, 2nd Edition, Wiley Blackwell, 2010.

E-Resource:

1. Video lecture: https://nptel.ac.in/courses/117105079/