NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
B.Tech. Electronics & Communication Engineering
Semester - V
<u>Department Elective I</u>

L	T	P	C
3	-	2	4

Course Code	2ECDE51
Course Title	Image Processing

Course Outcomes (COs):

At the end of the course, the students will be able to
1. Apply spatial and frequency domain image filters for Image enhancement.
2. Comprehend image degradation models for image restoration and colour transforms.
3. Apply morphological operations for image morphing applications.
4. Interpret and apply edge detection, image segmentation and representation for image recognition.

Syllabus: **Teaching Hours:45**

UNIT I: Introduction   **02**
Structure of the Human Eye, Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Spatial Domain Filtering, image compression techniques.

UNIT II: Spatial Domain Filtering
Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian, 2D sampling, 2D convolution and correlation.   **07**

UNIT III: Filtering in the Frequency Domain
2D FT transforms and its properties, Discrete Cosine Transform, Frequency domain filtering.   **05**

UNIT IV: Image Restoration
Basic Framework, Image degradation model, Noise characterization, Noise restoration filters, Adaptive filters, Estimation of Degradation functions, Restoration Techniques   **06**

UNIT V: Color Image Processing
Color Fundamentals Color Models Pseudocolor Image Processing Basics of Full-Color Image Processing Color Transformations Smoothing and Sharpening Color Segmentation in HSI Color Space Segmentation in RGB Vector Space.   **04**

UNIT VI: Morphological Image Processing
Basics of Structuring Element, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, convex hull, thinning, thickening, skeletons, pruning.   **06**

UNIT VII: Edge Detection and Image Segmentation
Detection of Discontinuities, Edge detectors, Canny edge detector, Hough Transform, Pixel and Region-Based Segmentation   **08**

UNIT IX: Object Recognition
Representation, Boundary Descriptors, Regional Descriptors, Fourier descriptors, Case studies and applications   **07**

Self-Study:
The self-study content will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Laboratory Work:
Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Readings:
1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison Wesley
2. A.K. Jain, Fundamentals of Digital Image Processing, Prentice-Hall
3. S. Sridhar, Digital Image Processing, Oxford University Press
4. Vipula Singh, Digital Image Processing with MATLAB and Lab View, Elsevier
5. S. Jayaraman, S.Esakkirajan, T. Veerakumar, Digital Image Processing, TMH

L = Lecture, T = Tutorial, P = Practical, C = Credit