

NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
Electronics & Communication Engineering

OPEN ELECTIVE

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Course Code	2ECOEO4
Course Title	Fundamentals of Image and Video 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 color space transforms for color image processing.
3. Interpret and apply edge detection, image segmentation and representation for image recognition.
4. Demonstrate the use of image and video processing algorithms for different applications.

Syllabus:

Teaching Hours:45

UNIT 1: Introduction

Structure of the Human Eye, Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Spatial Domain Filtering, **06**

UNIT II: Spatial and Frequency Domain Filtering

Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian, Frequency domain filtering. **07**

UNIT III: Image and Video Compression Standards

Basics of Discrete Cosine Transform, JPEG compression standard, H.261 video compression standard. **05**

UNIT IV: Image Restoration

Basic Framework, Image degradation model, Noise characterization, Noise restoration filters, Adaptive filters, and Estimation of Degradation functions, Restoration Techniques. **06**

UNIT V: Color Image Processing

Color Fundamentals Color space transformation Models Pseudocolor Image Processing. **03**

UNIT VI: Morphological Image Processing

Basics of Structuring Element, Erosion, Dilation, Opening, Closing. **03**

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. **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.

Assignments:

The students will be given 8-10 programming/simulation/projects/assignments based on the syllabus as mentioned below:

- i. Image Enhancement Algorithms
- ii. Spatial Filtering Algorithms

- iii. Frequency Domain Filtering Algorithms
- iv. Image Restoration Algorithms
- v. Color Image Processing Algorithms
- vi. Image and Video compression Standards
- vii. Morphological Image Processing Methods
- viii. Image Segmentation Algorithms
- ix. Object Recognition algorithms
- x. Mini Project

Suggested Readings:

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Addison Wesley
2. Sridhar, Digital Image Processing, Oxford University Press
3. Vipula Singh, Digital Image Processing with MATLAB and LabView, Elsevier
4. S. Jayaraman, S. Esakkirajan, T. Veerakumar, Digital Image Processing, TMH

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