DSE-01 (c): Digital Image Processing

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Digital Image Processing	4	3	0	1	Class XII with Mathematics	NIL

***Learning objectives*:**

1. *To understand the sensing, acquisition and storage of digital images.*
2. *To study the image fundamentals and mathematical transforms necessary for image processing.*
3. *To understand the digital processing systems and corresponding terminology.*
4. *To understand the base image transformation domains and methods.*

Learning Outcomes:

1. *Understand the fundamentals of Image Processing and its role and importance in avariety of applications.*
2. *Write programs to read/write and manipulate images for the purpose of enhancement.*
3. *Understand the need for image transforms and their properties.*
4. *Understand different causes for image degradation and use various techniques to restore images.*

UNIT-I **(8 hours)**

Introduction: Digital Image Fundamentals, Brightness, Adaptation and Discrimination, Light and Electromagnetic Spectrum, Image Sampling and Quantization, Some Basic Relationships between Pixels Types of images.

UNIT-II **(7 hours)**

Spatial Domain Filtering: Some Basic Intensity Transformation Functions, Histogram Equalization, Spatial Correlation and Convolution, Smoothening Spatial Filters-Low pass filters, Order Statistics filters; Sharpening Spatial Filters- Laplacian filter.

UNIT-III **(8 hours)**

Filtering in Frequency Domain: The Discrete Fourier Transformation (DFT), Frequency Domain Filtering:-Ideal and Butterworth Low pass and high pass filters

UNIT-IV **(7 hours)**

Image Degradation and Compression: Noise models, Noise Restoration Filters, Fundamentals of Image Compression, Huffman Coding, Run Length Coding

UNIT-V **(10 hours)**

Morphological Image Processing: Erosion, Dilation, Opening, Closing, Hit-or-Miss Transformation, Basic Morphological Algorithms.

UNIT VI **(5 hours)**

Image Segmentation: Point, Line and Edge Detection, Thresholding.

References:

1. *Gonzalez, R. C., & Woods, R. E. Digital Image Processing. 4th edition. Pearson Education, 2017*
2. *Castleman, K. R. Digital Image Processing. 1st edition. Pearson Education,2007*
3. *Gonzalez, R. C., Woods, R. E., & Eddins, S. Digital Image Processing using MATLAB. Pearson Education Inc., 2004*
4. *Jain, A. K. Fundamentals of Digital Image Processing. 1st edition Prentice Hall of India, 1988.*

List of practicals (30 Hours)

1. Write program to read and display digital image using MATLAB or SCILAB
a. Become familiar with SCILAB/MATLAB Basic commands
b. Read and display image in SCILAB/MATLAB
c. Resize given image
d. Convert given color image into gray-scale image
e. Convert given color/gray-scale image into black & white image
f. Draw image profile
g. Separate color image in three R G & B planes
h. Create color image using R, G and B three separate planes
i. Flow control and LOOP in SCILA
j. Write given 2-D data in image file

2. To write and execute image processing programs using point processing method
a. Obtain Negative image
b. Obtain Flip image
c. Thresholding
d. Contrast stretching

3. To write and execute programs for image arithmetic operations
a. Addition of two images
b. Subtract one image from other image
c. Calculate mean value of image
d. Different Brightness by changing mean value

4. To write and execute programs for image logical operations
a. AND operation between two images
b. OR operation between two images
c. Calculate intersection of two images
d. Water Marking using EX-OR operation
e. NOT operation (Negative image)

5. To write a program for histogram calculation and equalization using
a. Standard MATLAB function
b. Program without using standard MATLAB functions
c. C Program

6. To write and execute program for geometric transformation of image
a. Translation
b. Scaling
c. Rotation
d. Shrinking
e. Zooming

7. To understand various image noise models and to write programs for
a. image restoration
b. Remove Salt and Pepper Noise
c. Minimize Gaussian noise
d. Median filter and Weiner filter

8. Write and execute programs to remove noise using spatial filters
a. Understand 1-D and 2-D convolution process
b. Use 3x3 Mask for low pass filter and high pass filter

9. Write and execute programs for image frequency domain filtering
a. Apply FFT on given image
b. Perform low pass and high pass filtering in frequency domain
c. Apply IFFT to reconstruct image

10. Write a program in C and MATLAB/SCILAB for edge detection using different edge detection mask

11. Write and execute program for image morphological operations erosion and dilation.