



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3172417

Semester – VII

Subject Name: **Image Processing**

Type of course: Professional Elective Course

Prerequisite: Transform Techniques

Rationale: Image processing is very important aspect in various industrial fields. This course will help to understand the fundamental knowledge of image processing. Student will learn various processes on images for better understanding. Students will also learn to apply various processing techniques to enhance the image for further analysis purpose. The course is very useful for design and realization of image processing applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Course Content	Total Hrs.
1	Introduction Concept of digital image processing, Image processing steps, components of image processing system, Industrial applications areas.	2
2	Digital Image Fundamentals Image sensing and acquisition, Basic concept of sampling and quantization, representations of digital image, spatial and gray level resolution, Basic relationship between pixels.	7
3	Image Enhancement in Spatial Domain Basic gray level transformations, image negation, log transformations, power law transformations, piece wise linear transformations, histogram processing, Image enhancement using arithmetic and logical operations, Fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters.	8
4	Frequency Domain Filters Smoothing using frequency domain filters: Ideal low pass filter, Butterworth low pass filter, Gaussian low pass filters, Sharpening using frequency domain filters: Ideal high pass filter, Butterworth high pass filters, Gaussian high pass filters. Laplacian in frequency domain.	8
5	Color Image Processing Color fundamentals, color models, Intensity slicing, intensity slicing, color transformation, color image smoothing and sharpening.	6
6	Wavelet Transform in image processing. Sub band coding, Haar Transform, Multi resolution expansions, Wavelet Transform in one dimensions, Fast Wavelet Transform.	6
7	Morphological Image Processing	8



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3172417

Concept of Morphological operations, dilation & erosion, opening & closing operations, basic morphological operations such as boundary extraction, region filling, thinning, thickening, skeletons, pruning for images, Morphological operations for gray scale images
--

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	15	20	10	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital image processing", Pearson Education publication
2. Pratt W.K., "Digital Image Processing", John Wiley publication

References Books:

1. Jain A.K., "Fundamentals of Digital Image Processing", PHI
2. Mark Nixon, Alberto Aguado, "Feature Extraction and Image Processing", Academic Press, 2008.
3. Milan Sonka, "Image Processing Analysis & Machine Vision", Thomson Publication
4. K.D.Soman and K.I.Ramchandran, "Insight into wavelets - From theory to practice", PHI

Course Outcomes: At the end of this course, students will be able

Sr. No.	CO statement	Marks % weightage
CO1	To apply principles and techniques of digital image processing in applications related to digital imaging system.	25
CO2	To understand image model.	25
CO3	To perform filtering to enhance image	30
CO4	To use various image transforms to analyze and modify image	20

Suggested list of experiments:

- 1) Introduction to image processing toolbox.
- 2) Read an 8 bit image and then apply different image enhancement techniques:
- 3) Gray level Transformation
- 4) Different interpolation techniques
- 5) Histogram processing and equalization
- 6) Arithmetic and Logical operation
- 7) Smoothing filters
- 8) Sharpening filter
- 9) Color image processing
- 10) Edge Detection



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering **Subject Code: 3172417**

- 11) Wavelet Transform
- 12) Morphological operations on binary images
- 13) Erosion and dilation, opening & closing operation

Design based Problems (DP)/Open Ended Problem:

Find out the application of image processing in industrial field. Do the simulation of the application using image processing.

Major Equipment: Computers, simulation software – MATLAB/ SciLab, etc.

List of Open Source Software/learning website:

<http://nptel.ac.in/video.php>

<https://nptel.ac.in/courses/117/105/117105079/>

<https://nptel.ac.in/courses/117/105/117105135/>