GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT NAME: IMAGE PROCESSING
SUBJECT CODE: 2170712
B.E. 7th SEMESTER

Type of course: Bachelor of Engineering (Information Technology)

Prerequisite:

1. Knowledge of Fourier transform
2. Probability theory
3. Good programming skills.

Rationale:

This course will provide students with more techniques in the digital image processing for image enhancement as well as restoration of noisy images. Emphasis is given more on implementation of various algorithms so that students will able to develop their own algorithm. The techniques covered in the syllabus have wide applicability in any field which needs to handle the image data.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
L	T	P	C	Theory Marks		Practical Marks			
				ESE (E)	PA (M)	PA (V) ESE		PA (I)	
3	0	2	5	70	30	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment;

Content:

Sr No	Course Content	No of Hrs	% Weight
1	**Digital image fundamentals:** Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbours of pixel adjacency connectivity, regions and boundaries, Distance measures, Applications.	08	20
2	**Image Enhancements:** In spatial domain: Basic gray level transformations, Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters. In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.	15	30
3	**Image Restoration:** Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering.	07	20
4	**Colour Image processing:** Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation.	05	05

5	**Wavelet and Multi-resolution processing:** Image pyramids, Multi-resolution expansion, wavelet transform.	04	10
6	**Image compression:** Introduction, Image compression model, Error-free compression, Lossy compression.	04	05
8	**Image segmentation:** Detection of discontinuities, Edge linking and boundary detection, thresholding.	05	10

Suggested Specification table with Marks (Theory):

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

Legends: R : Remembrance ; U = Understanding; A = Application; N= Analyze and E=Evaluation 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

Reference Books:

1. Digital Image Processing, Second Edition by Rafel C. Gonzalez and Richard E. Woods, Pearson Education
2. Digital Image Processing by Bhabatosh Chanda and Dwijesh Majumder, PHI
3. Fundamentals of Digital Image Processing by Anil K Jain, PHI
4. Digital Image Processing Using Matlab, Rafel C. Gonzalez and Richard E. Woods, Pearson Education

Course Outcome:

After learning the course the students should be able to:

1. Understand the basic image enhancement techniques in spatial & frequency domains
2. Understand the various kind of noise present in the image and how to restore the noisy image.
3. Understand the basic multi-resolution techniques and segmentation methods.
4. To apply this concepts for image handling in various fields.

List of Experiments:

- Experiments will be based on the topics taught in the theory.

Major Equipments:

1. Computer system with high computing power and main memory.

List of Open Source Software/learning website:

1. MATLAB with image processing toolbox.
2. Scilab (SIP)

Open ended problems:

1. Enhance the given degraded image (pick up any suitable degraded image which contains letters also) such that we may be able to read the letter properly. Try to get best possible quality of image.
2. Identify type of the noise present in the image using frequency as well as in spatial domain concepts and judge the basic behavioral characteristics of the various noises.
3. Capture the real time binary photo and apply the various segmentation algorithms to identify the various objects presents in the image (i.e road, trees, river etc.)
4. Assign face recognition problem.