GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code:3724711
Semester – II
Subject Name: Advance Machine Vision and Applications (Prog. Elective – IV)

Type of course: Engineering

Prerequisite: N.A.

Rationale: This subject gives understanding about the various acquisition and enhancement techniques of image processing in mechatronics domain.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Digital image fundamentals; sampling and quantization; various gray level transformations; histogram processing; image enhancement using logical operators and spatial filtering (smoothing and sharpening filters); Image enhancement using frequency domain (Fourier transform; high pass and low pass filters); Ideal-Butter worth-Gaussian filters; Laplacian filter, image restoration	14
2	Colour Image Processing: Colour models; colour transformations; smoothing and sharpening; colour segmentation; noise in colour image	5
3	Image compression: Fundamentals; error-free compression techniques (variable length coding; LZW; bit plane coding), lossy compression	6
4	Morphological Image Processing: Background; dilation and erosion; opening and closing; basic morphological algorithms (boundary extraction, region filling, convex hull, thickening, thinning, hit-or-miss transformation, top hat transformation, etc.)	5
5	Image Segmentation: Detection of discontinuities; edge linking and boundary detection; thresholding; region based segmentation; segmentation by morphological water shade	5
6	Representation and description: Representation techniques; boundary descriptors; region descriptors	5

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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	**30**	**20**	**5**	**10**	**5**

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.

Reference Books:

1. Digital Image Processing
   Rafael C. Gonzalez, and Richard E. Woods, Pearson Publication
2. Digital Image Processing using MATLAB
   Rafael C. Gonzalez, and Richard E. Woods, Pearson Publication
3. Fundamentals of Digital Image Processing
   Anil K. Jain, PHI Learning Pvt. Ltd.
4. Principles of Digital Image Processing
   Wilhelm Burger, and Mark James Burge, Springer Publication

Course Outcomes:

After learning the course the students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Find the scope of machine vision in manufacturing automation.	30
CO-2	Judge the role of machine vision to increase the productivity in terms of quantity and quality of product.	30
CO-3	Develop a logical programming methodology using relevant software for digital image processing.	20
CO-4	Role of machine vision as multidisciplinary technique for mechatronics engineers.	20

List of Experiments:

1. Learning of Image processing software (2 turns)
2. Practical related to image sharpening (spatial and frequency domain)
3. Practical related to image blurring (spatial and frequency domain)

4. Image enhancement by contrast stretching
5. Histogram equalization and matching
6. Intensity transformation by various transfer function
7. Arithmetic operators
8. Logical operators
9. Fourier transfer of gate function
10. Noise removal
11. Demonstration of application with digital camera

Major Equipment:

1. MATLAB or LabVIEW or any other equivalent software
2. Digital camera

List of Open Source Software/learning website:

NPTEL