



SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology



B. Tech. Semester V

Subject Name: Fundamentals of Image Processing **Subject Code: BTEC15503**
Type of course: OE
Prerequisite: Knowledge of Fourier Transform
Rationale: This is fundamental course of computer vision. It will strengthen fundamental knowledge about digital image processing techniques. It is used in almost all engineering fields and wide range of applications in industrial automation, medical, agriculture, security, entertainment, education and many more.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

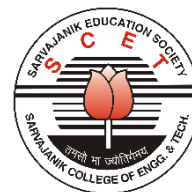
CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. no.	Topics	Teaching Hrs.	Module % Weightage
1.	Introduction : Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures, Applications of digital image processing	4	10
2.	Spatial and Frequency Domain Filtering: Intensity transformations, contrast stretching, histogram equalization, Specification Correlation, and convolution, Smoothing filters, sharpening filters, gradient, and Laplacian, Frequency domain filtering Low pass and High Pass, Homomorphic Filter	8	20
3.	Image Restoration: Basic Framework, Image degradation model, Noise characterization, Noise restoration filters, Adaptive filters, and Estimation of Degradation functions, Restoration Techniques.	6	10
4.	Image Segmentation : Detection of discontinuities, edge linking and boundary detection, thresholding: global and adaptive, Canny edge detector, Hough Transform, region-based segmentation.	8	20
5.	Color Image Processing:	4	10



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	Color fundamentals, color models, Pseudo color image processing , basics of full color image processing, color transforms, smoothing and sharpening , color segmentation.		
6.	Image compression : Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.	5	10
7.	Morphological Image Processing: Basics of Structuring Element, Erosion, Dilation, Opening, Closing.	6	10
8.	Object Recognition : Patterns and patterns classes, recognition based on decision– theoretic methods, matching, optimum statistical classifiers, neural networks, structural methods – matching shape numbers, string matching.	4	10

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	30	20	10	10	-

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **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.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Rafael C. Gonzalez, Richard E. Woods	Digital Image Processing	Pearson	2010	3rd
2.	Fundamentals of Digital Image Processing	Anil K. Jain	Pearson	2002	Latest
3.	Digital Image Processing using MATLAB	Rafael C. Gonzalez	Pearson Education	2011	Latest
4.	Digital Image Processing	S Jayaraman, S Esakkirajan,	Tata McGraw Hill Publication	2009	Latest
5.	Digital Image Processing	S Sridhar	Oxford University	2009	Latest



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Course Outcome:

Sr. No.	CO Statement After learning this subject students will be able to	Marks % weightage
CO-1	Enhance digital image quality by spatial and frequency domain filtering techniques	25
CO-2	Apply suitable image restoration techniques to minimize effect of degradation and noise for digital image	20
CO-3	Analyse given digital image & video by segmentation and morphological operations	20
CO-4	Apply concept of compression to Compress digital image by applying digital image compression algorithms	20
CO-5	Recognize the objects from digital images effectively	15

Mapping with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	2	2		2	2	-	-	2	2	-	-
CO-2	3	3	2	2	2	2	-	-	2	2	-	-
CO-3	3	3	2	2	2	3	-	-	2	2	-	-
CO-4	3	2	2	3	2	2	-	-	2	2	-	-
CO-5	2	3	3	3	3	2	2	2	2	3	2	2

List of Practical:

- 1 (a) To read color image and convert it into gray scale.
 (b) To read gray scale image and convert it into binary image.
 (c) Convert binary image into negative image.
 (d) Apply spatial resolution on original image by sampling 1/2, 1/4, 1/16 & 1/32 .Resize the output image again into the original image with the same sampling level & comment the result. Apply different interpolation (Nearest Neighbourhood, Bilinear & Bicubic) and comment on result
2. Read an 8 bit image and then apply different image enhancement techniques:
 - (a) brightness improvement
 - (b) brightness reduction
 - (c) thresholding
 - (d) negative of an image
 - (e) log transformation
 - (f) Power Law transformation.
3. (a) Implement Gray level slicing (intensity level slicing) to read image
 (b) To read an 8 bit image and to see the effect of each bit on the image.
 (c) To read an image and to extract 8 different planes i.e. ‘bit plane slicing’.Also combine all the plane and verify reconstructed image.
4. To read an image, plot its histogram then do histogram equalization and histogram specification. Comment in the result.
5. To Implement Smoothing spatial filter. Read an image and then corrupt it by ‘Salt and



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- Pepper', 'Gaussian', 'Speckle' noise then apply
- (a) AVERAGING filter with 3x3 mask and 5x5 mask.
 - (b) MEDIAN filter with 3x3 and 5x5 mask.
 - (c) Max, Min, Midpoint filter with 3x3. Comment on the results with MSE and PNSR parameter .
- 6 To read an image and apply
 - (1) Gaussian 3x3 mask for blurring
 - (2) High pass filter mask with different masks
 - (3) Laplacian operator with centre value positive and negative
 - (4) High boost filtering.
 - 7 Write a program to implement various low pass filters and High pass filters using Ideal filter , Butterworth filter and Gaussian filtering technique in frequency domain.
 - 8 Impalement various noise models for the image and plot is PDFs
 - 9 Write a program for erosion and dilation and opening & closing using inbuilt and without inbuilt function. Also perform Hit and Miss Operation
 - 10 To read an image and apply unsharp masking
 - 11 To read an image and apply Arithmetic mean filter, Geometric mean filter, Harmonic mean filter and contra harmonic mean filter.
 - 12 Perform Huffman coding image compression

List of Open Source/learning website:

- www.nptel.ac.in

List of Open Source Software:

- <https://www.scilab.org>
- OpenCV