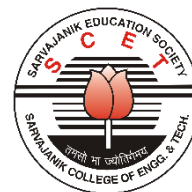




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Sarvajanik College of Engineering and Technology
Bachelor of Technology



B. Tech. Semester VI

Subject Name: Fundamentals of Image and Video Processing

Subject Code: BTEC13603

Type of course: PCC

Prerequisite: Knowledge of Fourier Transform and Digital Signal Processing

Rationale: This is fundamental course of computer vision. It will strengthen fundamental knowledge about digital image and video 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	150
3	0	2	4	60	25	15	30	20	

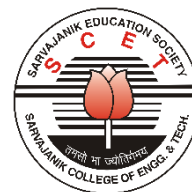
CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva 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 Fundamentals of Image processing : 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	5
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.	5	15
4.	Image Segmentation : Detection of discontinuities, edge linking and boundary detection, thresholding: global and adaptive, Canny edge detector, Hough	6	20



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	Transform, region-based segmentation.		
5.	Morphological Image Processing: Basics of structuring element, erosion, dilation, opening, closing	4	10
6.	Image compression : Need for data compression, Huffman, run length encoding, shift codes, arithmetic coding, JPEG standard	4	5
7.	Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations	4	5
8.	Video Compression Standards Basics of discrete cosine transform, MPEG and H.26x video compression standards, H.264, and overview of HEVC video compression standards.	5	10
9.	2-D Motion Estimation: Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.	5	10

Suggested Specification table with Marks (Theory):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	20	20	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. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Digital Image Processing	Rafael C. Gonzalez	Pearson	2010	3rd
2.	Digital Video Processing	Murat Tekalp	Pearson	2015	Latest
3.	Digital Image Processing using MATLAB	Rafael C. Gonzalez	Pearson	2011	Latest



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4.	Fundamentals of Digital Image Processing	Anil K. Jain	Pearson	2002	Latest
5.	Digital Image Processing	S Jayaraman, S Esakkirajan	Tata McGraw Hill Publication	2011	Latest
6.	Digital Image Processing,	S Sridhar	Oxford University	2010	Latest
7.	The essential guide to Video processing	Alan C. Bovik	Pearson	2018	Latest
8.	Handbook of Image and Video Processing	Alan Bovik	Academic Press	2011	Latest
9.	Video Processing and Communications	David Bull	Academic Press	2002	Latest

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 technique to minimize effect of degradation and noise for digital image	20
CO-3	Analyse given digital image and video by segmentation and morphological operations	20
CO-4	Apply concept of compression to digital image and video	20
CO-5	Design digital image and video processing projects to solve real life challenges	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	2	-	2	2	-	-	2	2	-	-	2	3	1
CO-2	3	3	2	2	2	2	-	1	2	2	1	-	-	3	-
CO-3	3	3	2	2	2	3	-	1	2	2	1	-	2	3	-
CO-4	3	2	2	3	2	2	-	1	2	2	-	1	-	3	2
CO-5	2	3	3	3	3	2	2	2	2	3	2	2	2	3	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.



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- (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 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. Find MSE and PSNR parameters and comment.
- 6 To read an image and apply
 - (1) Gaussian 3x3 mask for burring
 - (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
- 13 Compare video compression algorithms such as MPEG-4 or H.264 on a variety of videos
- 14 Implement block coding and predictive coding algorithm for motion estimation of video
- 15 Mini project

List of Open Source Software:

- Scilab
- Python
- OpenCV