Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Fourth Year Bachelor of Engineering (Computer/IT)

(To be Proposed For: Academic Year 2020-21)

Subject Code: CT704C-N	**Subject Title: Image Processing**
Pre-requisite	Computer Graphics, Digital Signal Processing, Knowledge of Fourier Transform

Teaching Scheme (Credits and Hours)

Teaching scheme				**Total Credit**	**Evaluation Scheme**					
L	**T**	**P**	**Total**		**Theory**		**Mid Sem Exam**	**CIA**	**Pract.**	**Total**
Hrs	**Hrs**	**Hrs**	**Hrs**		**Hrs**	**Marks**	**Marks**	**Marks**	**Marks**	**Marks**
04	00	02	06	05	03	70	30	20	30	150

Course Objective:

Image processing becomes a very important aspect in various industries ranging from process industry to medical field. This course will help to understand the fundamentals of image processing. Student will also learn to apply various processes on images for image understanding. The course also touches the design aspects and realization of image processing applications.

Introduce the student to analytical tools and methods which are currently used in digital image processing as applied to image information for human viewing. Then apply these tools in the laboratory in image restoration, enhancement and compression.

Outline of the Course:

Sr. No	**Title of theUnit**	**Minimum Hours**
1	Digital image fundamentals	8
2	Image Enhancements	10
3	Image Restoration:	12
4	Colour Image processing	9
5	Image Compression:	9
6	Morphological Image Processing:	8
7	Image Segmentation	8

Total hours (Theory):64
Total hours (Lab):32
Total hours:96

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Detailed Syllabus

Sr. No	TOPICS	Lecture Hours	Weightage(%)
1	**Digital image fundamentals:** Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbors of pixel adjacency, connectivity, regions and boundaries, Distance measures, Applications, Image Sampling and quantization	8	13
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, Gaussian	10	16
3	**Image Restoration:** Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering.	12	19
4	**Colour Image processing:** Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation.	9	14
5	**Image Compression:** Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard	9	14
6	**Morphological Image Processing**: Erosion, dilation, opening, closing, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons	8	12
7	**Image Segmentation** point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection, Hough transform	8	12
	Total	64	100

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Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

On successful completion of this course, the student should be able to:

- Apply knowledge of mathematics for image understanding and analysis.
- Design and analysis of techniques / processes for image understanding.
- Design, realize and troubleshoot various algorithms for image processing case studies.
- Select the appropriate hardware and software tools (Contemporary) for image analysis
- Understand image representation
- Enhance image quality using image enhancement techniques
- Filter given image using frequency domain filtering technique
- Select the right image restoration technique to remove degradation from given image
- Represent image using minimum number of bits using image compression
- Understand image segmentation technique
- Do morphological operations on given image

e-Resources:

- https://nptel.ac.in/courses

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

Reference Books:

- Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Third Edition, Pearson Education
- Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill Publication
- Digital Image Processing, S Sridhar, Oxford University Press.

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LIST OF EXPERIMENTS:

No	Name of Experiment
1	Introduction to Image Processing Toolbox
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	Implement different interpolation techniques using MATLAB/ Scilab.
4	Read an image, plot its histogram then do histogram equalization. Comment about the result.
5	(a) Implement Gray level slicing (intensity level slicing) in to read cameraman image. (b) Read an 8 bit image and to see the effect of each bit on the image. (c) Read an image and to extract 8 different planes i.e. 'bit plane slicing."
6	Implement various Smoothing spatial filter.
7	Read an image and apply (1) Gaussian 3x3 mask for burring (2) High pass filter mask with different masks (3) Laplacian operator with center value positive and negative (4) High boost filtering.
8	Write a program to implement various low pass filters and high pass filter in frequency domain.
9	Write a program for erosion and dilation, opening & closing using inbuilt and without inbuilt function.
10	Implement and study the effect of Different Mask (Sobel, Prewitt and Roberts).
11	Implement various noise models and their Histogram.