

Branch Name:	Signal Processing and Communication
Program Code:	ET214
Course Name:	Advanced Image Processing
Course Code:	2ET2140103T
Pre-requisite Course:	Knowledge of Digital Signal Processing and Engineering Mathematics.

Course Objectives:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques.
3. To study image restoration procedures.
4. To study the image segmentation and representation techniques.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40		-	-	-	100

Subject Contents				
Sr. No	Topic	Total Hours	Weight (%)	
1	Digital Image Processing Introduction: The origin of Digital Image Processing, examples of fields that use Digital Image Processing, fundamental steps in Digital Image Processing, components of Image Processing System.	02	07	
2	Digital Image Fundamentals: Elements of visual perception, light and the electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, basic relationship between pixels.	02	12	
3	Image enhancement in spatial domain: Basic gray level transformation functions, histogram processing, basics of spatial filtering, smoothing spatial filters, and sharpening spatial filters.	05	15	
4	Image Enhancement in Frequency Domain: Introduction to Fourier Transform and frequency domain, 1-D Discrete Fourier Transform (DFT), 2-D DFT, properties of 2-D DFT, basics of filtering in the frequency domain, smoothing frequency domain filters, sharpening frequency domain filters, selective filtering.	06	15	
5	Image Restoration: Model of image degradation /restoration process, noise models, restoration in the presence of noise only—spatial filtering, periodic noise reduction by frequency domain filtering, linear, position-invariant degradations, estimating the degradation function, inverse filtering, minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter.	07	15	
6	Morphological Image Processing: Dilation, erosion, opening and closing, hit-or-	05	12	

	miss transformation, basic morphological algorithms like boundary extraction, hole/region filling, thinning, thickening, skeleton of image.		
7	Image Segmentation: Point, line and edge detection, line detection using gradient based operators, advanced edge detection techniques like Marr-Hildreth edge detector, Canny edge detector and Hough Transform, segmentation using thresholding, Otsu's method, region based segmentation, watershed based segmentation.	06	12
8	Advanced Feature detection algorithms: Phase Congruency, Scale invariant feature transform, Describing Image motion, Template Matching, Deformable templates, Active Contours.	06	12

List of Text Book:

1. "Digital Image Processing", R. C. Gonzalez, R. E. Woods, 3/e Pearson Education.
2. "Feature Extraction and Image Processing", M. S. Nixon, A. S. Aguado, Second Edition, Academic Press, Elsevier.

List of Reference Books:

1. "Applied Pattern Recognition", Horst Bunke, Abraham Kandel, Springer International Edition, Springer.
2. "Image Processing and Mathematical Morphology", Frank Y. Shih, CRC Press
3. "Fundamentals of Digital Image Processing", A.K. Jain, Prentice Hall of India.
4. "Digital Image Processing using MATLAB", Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Pearson Education.
5. "Digital Image Processing", S. Jayaraman, S. Esakkirajan, McGraw Hill.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the basic concept of digital image processing, fundamental steps and Components of digital image processing	1 Remembering 2 Understanding
CLO2	Learn concept of Image enhancement, Image Segmentation, Morphological Image Processing	2 Understanding
CLO3	Understand the various digital image processing techniques in spatial/ frequency domain	2 Understanding
CLO4	Apply various tools and techniques for digital image quality enhancement in Spatial/frequency domain	3 Applying
CLO5	Analyze image to evaluate quality of the digital image	4 Analyze
CLO6	Design real time application using digital image processing concepts	6 Create

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1					L	M						H	H	M	L	
CLO2		H	M	M	L					L		H		M	L	
CLO3		M	H		L									H		L
CLO4		M	H		L			L					L		M	H
CLO5	H	M	H		L				L			H	L		M	H
CLO6	H	M	H		L							M	L		M	H

H:High, M:Medium, L:Low