

MOHAMMED SATHAK A J COLLEGE OF ENGINEERING
Siruseri IT park, OMR, Chennai - 603103

LESSON PLAN								
Department of Electronics and Communication Engineering								
Name of the Subject	DIGITAL IMAGE PROCESSING			Name of the handling Faculty	M.KAMARAJAN			
Subject Code	EC8093			Year / Sem	IV/VIII			
Academic Year	AY 2021-2022			Batch	2018-2022			
Course Objective								
To become familiar with digital image fundamentals								
To get exposed to simple image enhancement techniques in Spatial and Frequency domain.								
To learn concepts of degradation function and restoration techniques.								
To study the image segmentation and representation techniques.								
To become familiar with image compression and recognition methods								
Course Outcome								
At the end of the course, the students should be able to:								
CO1: Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.								
CO2:Operate on images using the techniques of smoothing, sharpening and enhancement								
CO3:Understand the restoration concepts and filtering techniques.								
CO4:Learn the basics of segmentation, compression and recognition methods for color models.								
CO5:Represent features of images and real time applications								
Lesson Plan								
Sl. No.	Topic(s)	T / R*	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC /	Blooms Level (L1-L6)	CO	PO	Page No
		Book						
UNIT I DIGITAL IMAGE FUNDAMENTALS								
1	Fundamental Steps in Digital Image Processing, Components of Image processing system	T1	1	BB,PPT	L1	CO1	PO1-PO2,PO12	25-30
2	Elements of visual perception:Structure of the Human eye,Image formation in the eye	T1	1	BB,NPTEL	L1	CO1	PO1-PO,,PO12	36-40
3	Brightness,Luminance or intensity Simultaneous contrast,Mach bands effect	T1	1	BB,PPT	L1	CO1	PO1-PO2	41-43
4	Image Sensing and Acquisition:Image Acquisition using a single sensor,Image acquisition Using sensor strips,Image acquisition Using sensor arrays,Image formation Model	T1	1	BB,PPT	L2	CO1	PO1-PO3,PO12	46-52
5	Image sampling and Quantization -Basic concepts of sampling, Nyquist rate, Aliasing & Moire effect Dither,Representing Digital Images,Spatial and Intensity resolution.	T1	1	BB,NPTEL	L2	CO1	PO1-PO3,PO12	52-64
6	Relationships between Pixel-Neighbors of a Pixel, Adjacency,Connectivity, Regions and Boundaries. Distance Measures.	T1	1	BB,NPTEL	L2	CO1	PO1-PO2	68-72
7	Color image fundamentals - RGB, HSI models, hue and saturation ,Chromaticity diagram	T1	1	BB,PPT	L2	CO1	PO1-PO2	395-407
8	Conversion between RGB & HIS	T1	1	BB,PPT	L3	CO1	PO1-PO2	395-407
9	Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.	T1	1	BB	L3	CO1	PO1-PO3	
Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any								Assignment
Evaluation method : Assignmen on Transforms 2D DFT								
UNIT II EMAGE ENANCHEMENT								
10	Gray level transformations	T1	1	PPT	L2	CO2	PO1-PO2	105-117
11	Histogram processing- Histogram equalization techniques ,Concept of Histogram & its processing	T1	1	BB,V-LAB	L4	CO2	PO1-PO4,PO5	120-128
12	Histogram specification techniques-Technique of Histogram matching,Implementation procedure	T1	1	PPT,NPETL	L2	CO2	PO1-PO3	128-138
13	Spatial Filtering -Averaging filters,Types of mask Mask generation	T1	1	PPT	L2	CO2	PO1-PO2,PO5	144-151
14	Smoothing and Sharpening Spatial Filtering Directional Smoothing,Spatial Low pass filtering	T1	1	PPT	L4	CO2	PO1-PO3	152-162
15	Smoothing- Basics of Filtering,Smoothing Using Frequency Domain Filters,Sharpening Using	T1	1	PPT	L3	CO2	PO1-PO3	255-280
6	Sharpening frequency domain filter Ideal, Butterworth and Gaussian filters	T1	1	PPT	L2	CO2	PO1-PO3	280-289
17	Homomorphic filtering	T1	1	BB	L3	CO2	PO1-PO3	289-293
18	Color image enhancement.	T1	1	PPT,NPETL	L2	CO2	PO1-PO3	Notes
Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any								
Simulation Demo: To enable the students understand the subject better.								
Evaluation method : Demonstrate the smoothing filter and Histogram using virtual tool								
UNIT III IMAGE RESTORATION								
19	Imge Restoration-degradation model	T1	1	BB,NPTEL	L2	CO3	PO1-PO3,PO4,PO12	311-313

20	Noise models	T1	1	PPT	L2	CO3	PO1-PO3	313-319
21	Spatial Filtering -Mean Filters,	T1	1	PPT	L4	CO3,CO5	PO1-PO3	322-330
22	Spatial Filtering-Order Statistics, Adaptive filters	T1	1	PPT	L2	CO3	PO1-PO3	322-330
23	Band reject Filters – Band pass Filters	T1	1	PPT	L2	CO3	PO1-PO3	335-338
24	Notch Filters – Optimum Notch Filtering	T1	1	PPT	L2	CO3	PO1-PO3	337-342
25	Inverse Filtering	T1	1	BB	L3	CO3	PO1-PO3	351-361
26	Wiener filtering Wiener filter for non zero mean images	T1	1	BB	L3	CO3	PO1-PO3	351-361
27	Least square error filter	T1	1	BB	L2	CO3	PO1-PO3	351-361

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
Miniproject: Image denoising

Evaluation method : Team of students combined and asked to write a MATLAB code for using any filter.

UNIT IV IMAGE SENGMENTATION

28	Segmentation: Detection of Discontinuities	T1	1	BB	L2	CO4	PO1-PO3	692-697
29	Edge Linking and Boundary detection	T1	1	BB	L2	CO4	PO1-PO3	697-725
39	Edge linking via Hough transform	T1	1	PPT	L2	CO4	PO1-PO3	733
31	Thresholding	T1	1	PPT	L2	CO4	PO1-PO5	738746
32	Region based segmentation – Region growing – Region splitting and merging	T1	1	PPT,NPETL	L2	CO4	PO1-PO3,PO4,PO12	763-766
33	Morphological processing- erosion and dilation	T1	1	BB,NPETL	L2	CO4	PO1-PO3	630-635,642
34	Segmentation by morphological watersheds – basic concepts – Dam construction	T1	2	PPT	L3	CO4	PO1-PO2	769-774
35	Watershed segmentation algorithm	T1	1	PPT	L3	CO4	PO1-PO3	774776

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

Quiz

Evaluation method : Online MCQ Quiz

UNIT V IMAGE COMPRESSION AND RECOGNITION

36	Need for data compression-Huffman, Run Length Encoding	T1	1	BBT,NPETL	L2	CO4	PO1-PO3	525-544,553
37	Shift codes	T1	1	BBT	L3	CO4	PO1-PO3	Notes
38	Arithmetic coding	T1	1	BBT	L3	CO4	PO1-PO3	548550
39	JPEG standard, MPEG	T1	1	PPT	L2	CO4	PO1-PO3,PO12	538,540,595
40	Boundary representation-Boundary Following Polygonal approximation,Chain Code	T1	1	PPT	L2	CO5	PO1-PO3	796-807
41	Boundary description, Boundary Descriptors Shape number, Fourier Descriptor, moments	T1	1	PPT	L2	CO5	PO1-PO3	815-821
42	Regional Descriptors -Simple Descriptors Topological feature	T1	1	PPT	L2	CO4	PO1-PO3	822-827
43	Texture– Patterns and Pattern classes	T1	1	BB	L2	CO5	PO1-PO3	827-838
44	Recognition based on matching	T1	1	BB	L2	CO5	PO1-PO3	NOTES

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
Assignment on Arithmetic coding

Evaluation method: Assignment

Content Beyond the Syllabus Planned

1	Smoothing of digital images Using Linear Filter- MATLAB
2	Significance of Image Processing in Medical Applications

Text Books

1	Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition, 2010.
2	Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.

Reference Books

1	Kenneth R. Castleman,Digital Image Processing Pearson, 2006.
2	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
3	D.E. Dudgeon and RM. Mersereau,Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
4	William K. Pratt,Digital Image Processing John Wiley, New York, 2002
5	Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

Website / URL References

1	https://npptel.ac.in/courses/117/105/117105135/
2	https://npptel.ac.in/courses/117/105/117105079/
3	https://npptel.ac.in/courses/117/104/117104069/
4	https://npptel.ac.in/courses/106/105/106105032/
5	

Blooms Level

Level 1 (L1) : Remembering	Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analysing		Higher Order Thinking	Projects / Mini Projects
Level 2 (L2) : Understanding			Level 5 (L5) : Evaluating			
Level 3 (L3) : Applying			Level 6 (L6) : Creating			

Mapping syllabus with Bloom's Taxonomy LOT and HOT

Unit No	Unit Name	L1	L2	L3	L4	L5	L6	LOT	HOT	Total
Unit 1	DIGITAL IMAGE FUNDAMENTALS	0	7	2	0	0	0	9	0	9
Unit 2	EMAGE ENANCHMENT	0	5	2	2	0	0	7	2	9

Unit 3	IMAGE RESTORATION					0	6	2	1	0	0	8	1	9
Unit 4	IMAGE SENGMENTATION					0	6	3	0	0	0	9	0	9
Unit 5	IMAGE COMPRESSION AND RECOGNITION					0	7	2	0	0	0	9	0	9
Total						0	31	11	3	0	0	42	3	45
Total Percentage						0.00	68.89	24.44	6.67	0.00	0.00	93.33	6.67	100.00
CO PO Mapping														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	1	0
CO2	3	2	2	-	-	-	-	-	-	-	-	1	1	0
CO3	3	2	1	-	-	-	-	-	-	-	-	1	1	0
CO4	3	1	1	-	-	-	-	-	1	-	-	1	1	0
CO5	3	1	1	-	-	-	1	-	-	-	-	1	0	0
Avg	3	1.6	1.4	0	0	0	0.2	0	0.2	0	0	1	0.8	0
Justification for CO-PO mapping														
CO1	Strong knowledge of mathematical preliminaries and science for image visualization(PO1) and relate it with signal toformulate various Image Transforms (PO2).Less relevance to provide solutions based design (PO3) by interpreting data (PO4), Less usage of modern tools to analyze image digitization artifacts (PO5) and less need to engage in life- long learning (PO12).													
CO2	High correlation for PO1,PO2 is given as the CO2 can be used to apply knowledge of mathematics,science and engineering fundamentals to formulate the enanchement filters for providing to identified problems(PO3).Moderate use of techniques to analyze,interpretation of data and synthesis of complex problems (PO4) using modern tools is less is (PO5). Moderate initiative to equip with the recent advancements (PO12)													
CO3	Strong fundamentals in mathematics and engineering (PO1) to formulate the restoration filters (PO2) for specific applications (PO3) and objectively conclude from the analysis (PO4).Less usage of modern tools to visualize the degradation process (PO5) and constantly update the knowledge (PO12).Weak impact to assess socio - relevant issues (PO6).													
CO4	Strong engineering knowledge (PO1) to analyze and conclude from the extracted ROI in medical applications ans compression algothrims (PO4).Moderate initiative to identify problems from the literature (PO2) and develop solutions (PO3) using modern engineering tools (PO5). Build vigor to engage in independent learning (PO12).Weak impact to assess societal issues (PO6) and propose the solutions relevant to them (PO7) by working in multidisciplinary environment .													
CO5	Strong engineering and mathematical knowledge (PO1) to analyze the problems in real-time situations (PO2).Moderate usage of engineering tools (PO5) to develop the processes (PO3) after necessary data interpretations (PO4) through the updated knowledge (PO12). Weak impact to assess societal issues (PO6) and propose the solutions relevant to them (PO7) by working in multidisciplinary environment (PO9).													
3		High level			2		Moderate level			1		Low level		
Name & Sign of Faculty Incharge : M.Kamarajan														
Name & Sign of Subject Expert :														
Head of the Department : Mr Kamarajan														

Format No :231