GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730303
Semester – III
Image processing for Instrumentation

Type of course:

Prerequisite: None

Rationale: Digital images are everywhere these days – in thousands of scientific, consumer, and industrial applications. The ability to process image signal is therefore an incredibly important skill to master for engineering students, software developers, and practicing scientists. This course will introduce fundamental technologies for digital image representation, compression, analysis, and processing. Students will gain understanding of algorithm/system design, analytical tools, and practical implementations of various digital image applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction Digital image processing and its origin, Applications, Fundamental steps, Components.	2
2	Digital Image Fundamentals Elements of visual perception, Light and electromagnetic spectrum, Image sensing and acquisition, Image sampling and quantization, Basic relationship between pixels, Linear and nonlinear operations.	2
3	Intensity Transformations and Spatial Filtering Background, Some basic gray level transformations, Histogram equalization and histogram matching, Enhancement using arithmetic/ logic operations, Basics of spatial filtering, Smoothing spatial filters, Order statistics filters, Sharpening spatial filters, Implementation in MATLAB.	6
4	Image enhancement in the Frequency Domain Background, Introduction to the Fourier transform and the frequency domain, Smoothing frequency domain filters, Sharpening frequency domain filters, Implementation in MATLAB.	8
5	Image compression and Wavelet Fundamentals, Image compression models, Error free coding: variable length, LZW, bit-plane, 2D-Wavelet transform fundamentals, Wavelet coding.	6
6	Morphological Image Processing Preliminaries, Dilation and Erosion, Opening and closing, Hit-or-Miss	

	transformation, Basic morphological algorithms: boundary extraction, region filling, connected components,convex hull, Extensions to Gray scale image, Applications of gray scale morphology.	6
7	Image Segmentation Detection of discontinuities, Local processing, Global processing via Hough Transform, Thresholding: foundation, role of illumination, basic global thresholding, Region growing segmentation.	6

Reference Books:

(1) Digital Image Processing, by Rafael C. Gonzalez and Richard E. Woods, Pearson Education, Second Edition.
(2) Digital image processing using MATLAB, by Rafael C. Gonzalez Richard E. Wood and Steven L. Eddins,
Pearson Education, Second Edition
(3) Fundamentals of Digital image processing, by Anil K.Jain. PHI
(4) Image Processing, Analysis, and Machine Vision, by MilanSonka, Vaclav Hlavac, and Roger Boyle, Cengage learning
(5) Digital image processing, by S. Jayaraman, S. Esakkirajan, T. Veerakumar, Tata McGraw-Hill publication
(6) Digital image processing, by S. Sridhar, Oxford University press

Course Outcomes:

Sr. No.	**CO statement**	**Marks % weightage**
	After successful completion of this course the student will	
CO-1	get broad exposure to and understanding of various applications of image processing in industry, medicine, and defense.	15
CO-2	be able to conduct independent study and analysis of image processing problems and techniques.	35
CO-3	gain understanding of algorithm/system design, analytical tools, and practical implementations of various digital image applications.	35
CO-4	acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems	15

List of Open Source Software/learning website:

Software: COMSOL, CoventorWare, Ansys, SIMULIA, Intellisense, MEMS Plus, AutoCAD,

Websites:

1. https://nanohub.org/resources/180/share
2. https://onlinecourses.nptel.ac.in/noc19_me38/preview
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-777j-design-and-fabrication-of-microelectromechanical-devices-spring-2007/lecture-notes/
4. https://nptel.ac.in/courses/117105082/
5. https://www.digimat.in/
6. https://www.class-central.com/report/swayam-moocs-course-list/