

Course Code:	Course Title	Credit
CSDO601	Digital Signal & Image Processing	3

Prerequisite: Applied Engineering Mathematics	
Course Objectives:	
1	To understand the fundamental concepts of digital signal processing and Image processing
2	To explore DFT for 1-D and 2-D signal and FFT for 1-D signal
3	To apply processing techniques on 1-D and Image signals
4	To apply digital image processing techniques for edge detection
Course Outcomes: On successful completion of course, learners will be able to:	
1	Understand the concept of DT Signal and DT Systems
2	Classify and analyze discrete time signals and systems
3	Implement Digital Signal Transform techniques DFT and FFT
4	Use the enhancement techniques for digital Image Processing
5	Apply image segmentation techniques

Module No.	Unit No.	Topic details	Hrs.
1.0		Discrete-Time Signal and Discrete-Time System	10
	1.1	Introduction to Digital Signal Processing, Sampling and Reconstruction, Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals, Signal Manipulations (shifting, reversal, scaling, addition, multiplication).	
	1.2	Classification of Discrete-Time Signals, Classification of Discrete-Systems	
	1.3	Linear Convolution formulation for 1-D signal (without mathematical proof), Circular Convolution (without mathematical proof), Linear convolution using Circular Convolution. Auto and Cross Correlation formula evaluation, Concept of LTI system, Output of DT system using Time Domain Linear Convolution.	
2.0		Discrete Fourier Transform	05
	2.1	Introduction to DTFT, DFT, Relation between DFT and DTFT, IDFT	
	2.2	Properties of DFT without mathematical proof (Scaling and Linearity, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parseval's Energy Theorem). DFT computation using DFT properties.	
	2.3	Convolution of long sequences, Introduction to 2-D DFT	
3.0		Fast Fourier Transform	04
	3.1	Need of FFT, Radix-2 DIT-FFT algorithm,	
	3.2	DIT-FFT Flow graph for N=4 and 8, Inverse FFT algorithm.	
	3.3	Spectral Analysis using FFT	
4.0		Digital Image Fundamentals	05
	4.1	Introduction to Digital Image, Digital Image Processing System, Sampling and Quantization	
	4.2	Representation of Digital Image, Connectivity	
	4.3	Image File Formats: BMP, TIFF and JPEG.	
5.0		Image Enhancement in Spatial domain	09
	5.1	Gray Level Transformations, Zero Memory Point Operations,	
	5.2	Histogram Processing, Histogram equalization.	

	5.3	Neighborhood processing, Image averaging, Image Subtraction, Smoothing Filters - Low pass averaging, Sharpening Filters-High Pass Filter, High Boost Filter, Median Filter for reduction of noise	
6.0		Image Segmentation	06
	6.1	Fundamentals. Segmentation based on Discontinuities and Similarities	
	6.2	Point, line and Edge Detection, Image edge detection using Robert, Prewitt and Sobel masks, Image edge Detection using Laplacian mask	
	6.3	Region based segmentation: Region Growing, Region Splitting and Merging	
		Total	39

Textbooks:	
1	John G. Proakis, Dimitris and G .Manolakis, “ Digital Signal Processing: Principles, Algorithms, and Applications ”, 4th Edition, Pearson Education, 2007
2	A. Anand Kumar, “ Digital Signal Processing ”, 2nd Edition, PHI Learning Pvt. Ltd. 2014.
3	Rafel C. Gonzalez and Richard E. Woods, “ Digital Image Processing ”, Pearson Education Asia, 4th Edition, 2018.
4	S. Sridhar, “ Digital Image Processing ”, 2nd Edition, Oxford University Press, 2012.
References:	
1	Sanjit Mitra, “ Digital Signal Processing: A Computer Based Approach ”, 4th Edition, Tata McGraw Hill, 2013
2	S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, “ Digital Signal Processing ”, 2nd Edition, Tata McGraw Hill Publication, 2011.
3	S. Jayaraman, E. Esakkirajan and T. Veerkumar, “ Digital Image Processing ”, 3 rd Edition, Tata McGraw Hill Education Private Ltd, 2009.
4	Anil K. Jain, “ Fundamentals of Digital Image Processing ”, 4th Edition, Prentice Hall of India Private Ltd., 1989
Assessment:	
Internal Assessment:	
Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 50% syllabus is completed. Duration of each test shall be one hour.	
End Semester Theory Examination:	
1	Question paper will comprise of total six questions.
2	All question carries equal marks
3	Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4	Only Four question need to be solved.
5	In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Useful Links	
1	https://nptel.ac.in/courses/
2	https://swayam.gov.in