

Course Code	Course Name	Credits
CSC701	Digital Signal & Image Processing	4

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 the course learner will be able to:

1. Apply 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. Differentiate between the advantages and disadvantages of different edge detection techniques
6. Develop small projects of 1-D and 2-D Digital Signal Processing.

Prerequisite: Applied Mathematics

Module No.	Unit No.	Topic details	Hrs.
1.0		Discrete-Time Signal and Discrete-Time System	14
	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 and 2-D signal (without mathematical proof), Circular Convolution (without mathematical proof), Linear convolution using Circular Convolution. Auto and Cross Correlation formula evaluation, LTI system, Concept of Impulse Response and Step Response, Output of DT system using Time Domain Linear Convolution.	
2.0		Discrete Fourier Transform	08
	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 Parsevals' Energy Theorem). DFT computation using DFT properties.	
	2.3	Transfer function of DT System in frequency domain using DFT. Linear and Circular Convolution using DFT, Convolution of long sequences, Introduction to 2-D DFT	
3.0		Fast Fourier Transform	06
	3.1	Need of FFT, Radix-2 DIT-FFT algorithm,	

Module No.	Unit No.	Topic details	Hrs.
	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	08
	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	10
	5.1	Gray Level Transformations, Zero Memory Point Operations,	
	5.2	Histogram Processing, Histogram equalization.	
	5.3	Neighborhood Processing, Spatial Filtering, Smoothing and Sharpening Filters, Median Filter.	
6.0		Image Segmentation	06
	6.1	Segmentation based on Discontinuities (point, Line, Edge),	
	6.2	Image Edge detection using Robert, Sobel, Previtt masks, Image Edge detection using Laplacian Mask.	
		Total	52

Text Books:

1. John G. Proakis, Dimitris and G.Manolakis, 'Digital Signal Processing: Principles, Algorithms, and Applications' 4th Edition 2007, Pearson Education.
2. A. Anand Kumar, 'Digital Signal Processing', PHI Learning Pvt. Ltd. 2013.
3. Rafael C. Gonzalez and Richard E. Woods, 'Digital Image Processing', Pearson Education Asia, 3rd Edition, 2009,
4. S. Sridhar, 'Digital Image Processing', Oxford University Press, Second Edition, 2012.

Reference Books:

1. Sanjit Mitra, 'Digital Signal Processing: A Computer Based Approach', TataMcGraw Hill, 3rd Edition.
2. S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, 'Digital Signal Processing' Tata McGraw Hill Publication 1st Edition (2010).
3. S. Jayaraman, E. Esakkirajan and T. Veerkumar, 'Digital Image Processing' TataMcGraw Hill Education Private Ltd, 2009.
4. Anil K. Jain, 'Fundamentals and Digital Image Processing', Prentice Hall of India Private Ltd, 3rd Edition.

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 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question (Q.2 to Q.6) will be selected from all the modules.

Lab Code	Lab Name	Credits
CSL701	Digital Signal and Image Processing Lab	1

Lab Outcome: The learner will be able to

1. Sample and reconstruct the signal.
2. Implement and apply operations like Convolution, Correlation, DFT and FFT on DT signals
3. Implement spatial domain Image enhancement techniques.
4. Implement Edge detection techniques using first order derivative filters.

Description:

Implementation of programs can be in C or C++ or any computational software. A List of ten experiments is given below, are needed to be performed covering all syllabus modules. Additional experiments within the scope of the syllabus can be added.

Suggested List of Experiments:

1. Sampling and Reconstruction
2. To perform Discrete Correlation
3. To perform Discrete Convolution
4. To perform Discrete Fourier Transform
5. To perform Fast Fourier Transform
6. Implementation of Image negative, Gray level Slicing and Thresholding
7. Implementation of Contrast Stretching ,Dynamic range compression & Bit plane Slicing
8. Implementation of Histogram Processing
9. Implementation of Image smoothing/ Image sharpening
10. Implementation of Edge detection using Sobel and Previtt masks

Term Work:

- Laboratory work will be based on above syllabus of CSC701 - 'Digital Signal and Image Processing' with minimum 10 experiments to be incorporated.
- The distribution of marks for term work shall be as follows:

Lab Performance	15 Marks
Assignments	05 Marks
Attendance (Theory & practical)	05 Marks