

III B.Tech – II Semester
(20EC6640) DIGITAL IMAGE AND SPEECH PROCESSING
(Honors)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	4

Pre-Requisites: Digital Signal Processing

Course Objectives:

- To Familiarize with fundamental concepts of digital image processing.
- To Learn various image processing techniques like image enhancement, image restoration, image compression and segmentation.
- To understand the speech production mechanism and the various speech analysis techniques and speech models.
- To introduce linear predictive coding techniques in speech processing.

UNIT-I: DIGITAL IMAGE FUNDAMENTALS:

Introduction to Image Processing, Fundamental steps in digital image processing, Elements of visual perception, image sampling and quantization, Basic relationships between pixels, Introduction to various mathematical transforms used in digital image processing. Image types and formats: Binary image, Gray image, Color image, Color fundamentals, Color models: RGB, HSI and CMY.

UNIT-II: IMAGE ENHANCEMENT AND RESTORATION:

Intensity Transformations and Spatial Filtering: Intensity transformation functions, fundamentals of spatial filtering, smoothing spatial filters, and sharpening spatial filters. The basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters.

Image Restoration: A model of the 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.

UNIT-III: IMAGE COMPRESSION AND SEGMENTATION:

Image compression: Fundamentals, Image compression model, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding and Predictive coding.

Image segmentation: Fundamentals, point, line, edge detection, thresholding, and region based segmentation.

UNIT-IV: INTRODUCTION TO DIGITAL SPEECH PROCESSING:

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Time domain methods for speech processing: Time dependent processing of speech, short-time energy and average magnitude, short-time average zero crossing rate. digital representation of speech waveform: Sampling Speech signal, statistical model, instantaneous quantization, Adaptive quantization, Feed-forward Feedback adaptations.

UNIT-V: LINEAR PREDICTIVE ANALYSIS OF SPEECH SIGNALS:

Block diagram of Simplified Model for Speech Production. Basic Principles of Linear Predictive Analysis - The Auto Correlation Method. The Prediction Error Signal. Digital Speech Processing for Man-Machine

Communication by voice. Speaker Recognition Systems- Speaker verification and Speaker Identification Systems.

Course Outcomes:

After successful completion of the course, the students can be able to:

S. No	Course Outcome	BTL
1	Understand the fundamental concepts of digital image processing	L2
2	Apply image enhancement techniques in spatial and frequency domain	L3
3	Evaluate and execute compression and segmentation techniques for digital images	L4
4	Understand the speech production model and analyze time-domain models for speech signals	L2
5	Apply the linear predictive coding techniques in speech signals	L3

Correlation of COs with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	-	2	-	-	-	-	-	-	-	-	2	-
CO 2	3	2	-	2	-	-	-	-	-	-	-	-	2	-
CO 3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO 4	3	3	1	2	-	-	-	-	-	-	-	-	3	-
CO 5	3	2	1	2	-	-	-	-	-	-	-	-	3	-

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education, 3rd Edition, 2011.
2. S. Sridhar, Digital Image Processing, Oxford publishers, 2nd Edition, 2016.
3. L.R. Rabiner and R. W. Schafer, "Digital Processing of Speech Signals", Pearson Education, 2008.

Reference Books:

1. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson Education, 2015.
2. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice", 1st Edition, Pearson Education, 2008.