IMAGE AND VIDEO PROCESSING

II Semester: ESD

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB15	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**	**Total Classes: 45**

I. COURSE OVERVIEW:

This course provides a mathematical framework to describe and analyze images and videos as two- and three-dimensional signals in the spatial and frequency domains. It focuses on fundamentals of digital images, transforms, image enhancement in spatial, frequency domains, image compression techniques and introduces video processing sampling, filtering operation and motion estimation in the videos. Digital image processing motivated by major applications to process images and videos for solving practical problems of commercial and scientific interests for machine applications in industries for quality control.

II. COURSE OBJECTIVES:

The students will try to learn:
I.   The representation of digital images and video in the spatial (pixel) and frequency domains.
II. The principles and methods of motion/optical flow estimation; understand fundamentals of image compression and video compression basics of video transport over the internet.
III. How to analyze and interpret the results of image processing methods and algorithms.

III. COURSEOUTCOMES:

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

CO 1	**Outline** the principles and terminology of digital image processing for describing the features of image.	Understand
CO 2	**Demonstrate** 2D Fourier transforms and its properties for frequency domain representation of the image.	Understand
CO3	**Make use of** various image transform techniques like Walsh, Slant, Hadamard, DCT and Haar transforms for analyzing images in transform domain.	Apply
CO 4	**Construct** image intensity transformations and spatial filtering for image enhancement in the spatial domain.	Apply
CO 5	**Identify** 2D convolution and filtering techniques for smoothening and sharpening of images in frequency domain.	Apply
CO 6	**Illustrate** the analog video to digital video conversion using sampling and quantization methods.	Understand

IV. SYALLABUS:

UNIT-I	**FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS**	**Classes: 09**

Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.
Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

UNIT-II	IMAGE ENHANCEMENT	Classes: 09

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.
Frequency domain methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.

UNIT-III	IMAGE COMPRESSION	Classes: 09

Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy.

Compression models: Lossy & Lossless, Huffman coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

UNIT-IV	BASIC STEPS OF VIDEO PROCESSING	Classes: 09

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT-V	2-D MOTION ESTIMATION	Classes: 09

Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Text Books:

1. Gonzaleze and Woods , "Digital Image Processing ", 3rd Edition., Pearson,2007
2. Yao Wang, Joem Ostermann and Ya–quin Zhang , "Video Processing and Communication ", 1st Edition., PH Int

Reference Books:

1. Scotte Umbaugh, "Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools", 2nd Edition, CRC Press, 2011.
2. M. Tekalp, "Digital Video Processing", Prentice Hall International
3. S.Jayaraman, S.Esakkirajan, T.Veera Kumar, "Digital Image Processing", TMH, 2009.
4. John Woods, "Multidimentional Signal, Image and Video Processing and Coding", 2nd Edition, Elsevier.
5. Vipula Singh, "Digital Image Processing with MATLAB and Labview", Elsevier.
   Keith Jack, "Video Demystified – A Hand Book for the Digital Engineer", 5th Edition, Elsevier

Web References:

1. http://nptel.ac.in/courses/117105079/
2. http://nptel.ac.in/video.php?subjectId=117105079
3. http://nptel.ac.in/courses/106105032/