DIGITAL IMAGE AND VIDEO PROCESSING

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESC17	**ELECTIVE**	3	0	0	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 fundamentals of digital image and video processing and algorithms for most of the image and video applications.
II. The image enhancement, image segmentation and compression techniques in spatial and frequency domains and motion estimation in videos.
III. The algorithms to solve image and video processing problems to meet design specifications of various applications of image processing in industry, medicine and defense.
IV. Fundamentals of image and video representation and processing in MATLAB.

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
CO12	**Design and implement** MATLAB algorithms for image processing operations such as histogram equalization, enhancement, and restoration, filtering and denoising.	Create

IV. SYLLABUS:

MODULE – I:FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS (9)

Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels. 2-D Transforms of Haar, Walsh transformations. Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

MODULE – II: IMAGE ENHANCEMENT(9)

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.

MODULE – III:IMAGE COMPRESSION(9)

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

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

MODULE – IV:BASIC STEPS OF VIDEO PROCESSING(9)

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.

MODULE – V:2-DMOTIONESTIMATION

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

V. TEXT BOOKS:

1. Gonzalezand Woods, "Digital Image Processing", Pearson 3rd Edition, 2007.
2. Yao Wang, JoemOster Mann and Ya–quin Zhang, "Video Processing and Communication ", ,PHInt, 1st Edition, 2007.

VI. REFERENCE BOOKS:

1. Scotte Umbaugh, "Digital Image Processing and Analysis Human and Computer Vision Application with CVIP Tools", CRC Press, 2nd Edition, 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", Elsevier, 2nd Edition, 2009.
5. Vipula Singh, "Digital Image Processing with MATLAB and Labview", Elsevier.
6. KeithJack, "Video Demystified –A Hand Book for the Digital Engineer", Elsevier, 5th Edition, 2010.

VII. 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/

VIII. E-TEXT BOOKS:

1. iitlab.bit.edu.cn/.../Handbook%20of%20Image%20and%20Video%20Processing.pdf
2. www.sciencedirect.com/science/book/9780121197926.