INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DIGITAL IMAGE AND VIDEO PROCESSING							
III Semester: ES							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		

Course Code	Category	L	T	P	C	CIA	SEE	Total
BESE32	**Elective**	3	0	0	3	40	60	100

Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**	**Total Classes: 45**
Prerequisite: Digital Image Processing.			

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. COURSES OBJECTIVES:
The students will try to learn

I. The fundamentals of digital image and video processing and algorithms for most of the image and videoapplications.
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 applicationsof image processing in industry, medicine and defense.
IV. Fundamentals of image and video representation and processing in MATLAB.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO1   Outline the principles and terminology of digital image processing for describing the features ofimage.
CO2   Demonstrate 2D Fourier transforms and its properties for frequency domain representation of the image.
CO3   Make use of various image transform techniques like Walsh, Slant, Hadamard, DCT and Haar transforms for analyzing images in transform domain.
CO4   Construct image intensity transformations and spatial filtering for image enhancement in the spatialdomain.
CO5   Identify 2D convolution and filtering techniques for smoothening and sharpening of Images in frequency domain.
CO6   Illustrate the analog video to digital video conversion using sampling and quantization methods.

IV. COURSE CONTENT:

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-Dtransforms 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, 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 (9)
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-basedtransform coding, predictive coding, application of motion estimation in video coding.

V. TEXT BOOKS:
1. Gonzalez and Woods, "Digital Image Processing", Pearson 3rd edition, 2007.
2. Yao Wang, Joem Oster 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
2. Tools", CRC Press, 2nd Edition, 2011.
3. M. Tek alp, "Digital Video Processing", Prentice Hall International.
4. S. Jayaraman, S. Esakkirajan, T. Veera Kumar, "Digital Image Processing", TMH, 2009.
5. John Woods, "Multidimensional Signal, Image and Video Processing and Coding", Elsevier, 2nd Edition, 2009.
6. Vipula Singh, "Digital Image Processing with MATLAB and LabVIEW", Elsevier.
7. Keith Jack, "Video Demystified, a Hand Book for the Digital Engineer", Elsevier, 5th Edition, 2010.

VII. WEB RESOURCES:
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.

IX. MATERIALS ONLINE
1. Course template
2. Tutorial question bank
3. Assignments
4. Model question paper - I
5. Model question paper - II
6. Lecture notes
7. Power point presentations