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

COURSE CONTENT

DIGITAL IMAGE PROCESSING								
VI Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECD37	Elective	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: Signals and Systems								

I. COURSE OVERVIEW:
The course is intended to provide image processing fundamentals, representation, sampling, quantization, image acquisition and imaging geometry. Transform techniques including two dimensional Fourier transforms, Walsh, Hotelling, Haar and Slant transforms. Analyze image processing filters and techniques for the applications of enhancement, segmentation and compression.

II. COURSE OBJECTIVES:
The students will try to learn:

I. The fundamental concepts of digital image processing methods and techniques.
II. The image enhancement, image segmentation and compression techniques in spatial and frequency domains.
III. The algorithms to solve image processing problems to meet design specifications of various applications of image processing in industry, medicine and defense.
IV. Fundamentals of image 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 of image.
CO2 Demonstrate 2D Fourier transforms and its properties for frequency domain representation of the image and make use of various image transform techniques like Walsh, Hadamard, Slant, DCT and Haar transforms for analyzing images in transform domain.
CO3 Construct image intensity transformations and spatial filtering for image enhancement in the spatial domain.
CO4 Illustrate image degradation models, noise models for modeling of degradation function and distinguish the image restoration in the spatial and frequency domains to deal with different types of noise models for removing degradation from given image.
CO5 Apply region and edge based image segmentation techniques for detection of objects in images.
CO6 Compare lossy and lossless compression models for achieving image compression. Implement standard image processing algorithms alone or as a member of a small group to meet design specifications.

IV. COURSE CONTENT:

MODULE –I: INTRODUCTION (10)

Digital image fundamentals and image transforms digital image fundamentals, sampling and quantization, relationship between pixels; Image transforms: 2-D FFT, properties, Walsh transform, Hadamard transform, discrete cosine transform, Haar transform, Slant transform, Hoteling transform.

MODULE –II: IMAGE ENHANCEMENT (10)

Introduction, image enhancement in spatial domain, enhancement through point processing, types of point processing, histogram manipulation, linear and non-linear gray level transformation, local or neighborhood operation, medianfilter processing; Spatial domain high pass filtering, filtering in frequency domain, obtaining frequency domain filters from spatial filters, generating filters directly in the frequency domain, low pass (smoothing) and high pass (sharpening) filters in frequency domain.

MODULE –III: IMAGE SEGMENTATION AND MORPHOLOGICAL IMAGE PROCESSING (10)

Image segmentation detection of discontinuities, edge linking and boundary detection, threshold, region oriented segmentation, Watershed transformation. Morphological image processing dilation and erosion, structuring element decomposition, the Strel function, erosion;

Combining dilation and erosion: Opening and closing the hit and miss transformation, Boundary extraction ,Region filling, Extracted of connected components, convex hull ,skeletons, pruning, Thinning , Thickening.

MODULE –IV: IMAGE RESTORATION (08)

Image restoration degradation model, Noise models, Restoration in the presence of noise only (Spatial Filtering), Estimating the degradation function, Inverse filtering, Least mean square filters, constrained least square restoration.

MODULE –V: IMAGE COMPRESSION AND WAVELET BASED IMAGE PROCESSING (10)

Image compression: Redundancies and their removal methods, fidelity criteria, image compression models, source encoder and decoder, error free compression, lossy compression, Wavelet transform: Continuous wavelet transformation, 2D continuous wavelet transformation, Examples of wavelets, Wavelet based image compression.

V. TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Pearson, 3rd Edition, 2008.
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, “Digital Image Processing”, TMH, 3rd Edition, 2010.

VI. REFERENCE BOOKS:

1. Rafael, C. Gonzalez, Richard E woods, Stens L Eddings, “Digital Image Processing using MAT LAB”, Tata McGraw Hill, 2nd Edition, 2010.
2. A.K. Jain, “Fundamentals of Digital Image Processing”, PHI, 1st Edition, 1989.
3. Somka, Hlavac, Boyle, “Digital Image Processing and Computer Vision”, Cengage Learning, 1st Edition, 2008.
4. Adrain Low, “Introductory Computer vision Imaging Techniques and Solutions”, Tata McGraw-Hill, 2nd Edition,2008.
5. John C. Russ, J. Christian Russ, “Introduction to Image Processing & Analysis”, CRC Press, 1st Edition, 2010.

VII. WEB REFERENCES:

1. https://imagingbook.com/
2. https://en.wikipedia.org/wiki/Digital_image_processing
3. http://www.tutorialspoint.com/dip/
4. http://www.imageprocessingplace.com

VIII. ELECTRONICS RESOURCES:

1. http://bookboon.com/en/communication-ebooks-zip
2. http://www.bloomsbury-international.com/images/ezone/ebook/writing-skills-pdf.pdf
3. https://americanenglish.state.gov/files/ae/resource_files/developing_writing.pdf

IX. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Definition and terminology
4. Tech-talk topics
5. Assignments
6. Model question paper - I
7. Model question paper - II
8. Lecture notes
9. Early learning readiness videos (ELRV)
10. Power point presentations