

## FUNDAMENTALS OF IMAGE PROCESSING

VII SEMESTER: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC552	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 0	Practical Classes: Nil			Total Classes: 45			

**OBJECTIVES:**  
The course should enable the students to:

- I. Understand the image fundamentals and the relationship between pixels.
- II. Understand the image enhancement techniques in spatial domain and frequency domain.
- III. Analyze the image restoration technique from degraded image using various filtering techniques.
- IV. Design segmentation of the image for boundary detection.
- V. Differentiate redundancy techniques and apply for image compression.

**COURSE OUTCOMES (COs):**

CO 1: Review the fundamental concepts of a Digital Image Processing System. Analyze general terminology of DIP. Examine various types of Transforms

CO 2: Examine various types of images, intensity transforms and Image Enhancement with spatial filtering. Develop FT for Image Enhancement in frequency domain. Analyze images in the frequency domain Using various filters.

CO 3: Evaluate the model, approaches, and filtering techniques for image Restoration.

CO 4: Interpret Image Segmentation and representation techniques. Evaluate the methodologies for image segmentation, restoration etc.,

CO 5: Categorize various Compression techniques and Interpret Image Compression standards.

**COURSE LEARNING OUTCOMES (CLOs) :**

- 1. Understand the image fundamentals, image transforms, relationship between pixels.
- 2. Explore sampling and quantization in terms of images.
- 3. Analyze the types of transforms, properties mathematical proofs etc.,
- 4. Determine the Advanced transforms, implementations using software's
- 5. Explore the Image enhancement in spatial domain, different types of point processing.
- 6. Understand the Histogram , histogram manipulation, Linear and nonlinear gray level transformation.
- 7. Analyze the Local or neighborhood operation, median filter processing, Spatial domain high pass filtering etc..
- 8. Generating filters directly in the frequency domain, obtaining frequency domain filters from spatial filters.
- 9. Understand the filtering in frequency domain, smoothing and sharpening filters in frequency domain.
- 10. Understand the Image restoration degraded model.
- 11. Determine algebraic approach to restore and inverse filtering.
- 12. Understand least mean square filters.
- 13. Determine the constrained least square restoration, restoration, image restoration.
- 14. Illustrate the Image segmentation detection of discontinuities and edge linking and boundary detection.
- 15. Determine the threshold and the region oriented segmentation morphological image processing dilation and erosion.
- 16. Understand structuring element decomposition, the strel function, opening and closing and hit and miss transform
- 17. Describe the image compression, redundancies and removal methods.
- 18. Understand fidelity criteria, image compression models, source encoder and decoder, error free compression.
- 19. Determine lossy compression, JPEG 2000 standard.

<b>UNIT-I</b>	<b>INTRODUCTION</b>	<b>Classes: 09</b>
Digital image fundamentals and image transforms digital image fundamentals, sampling and quantization, relationship between pixels.		
<b>UNIT-II</b>	<b>IMAGE ENHANCEMENT</b>	<b>Classes: 09</b>
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, median filter 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		
<b>UNIT-III</b>	<b>IMAGE RESTORATION</b>	<b>Classes: 9</b>
Image restoration degradation model, algebraic approach to restoration, inverse filtering. Least mean square filters, constrained least square restoration, interactive restoration.		
<b>UNIT-IV</b>	<b>IMAGE SEGMENTATION, MORPHOLOGICAL IMAGE PROCESSING</b>	<b>Classes: 9</b>
Image segmentation detection of discontinuities, edge linking and boundary detection, threshold, region oriented segmentation. 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.		
<b>UNIT-V</b>	<b>IMAGE COMPRESSION</b>	<b>Classes: 09</b>
Image compression: Redundancies and their removal methods, fidelity criteria, image compression models, source encoder and decoder, error free compression, lossy compression, JPEG 2000 standard.		
<b>Text Books:</b>		
1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 3 <sup>rd</sup> Edition, 2008. 2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, "Digital Image Processing", TMH, 3 <sup>rd</sup> Edition, 2010.		
<b>Reference Books:</b>		
1. Rafael, C. Gonzalez, Richard E woods, Stens L Eddings, "Digital Image Processing using MATLAB", Tata McGraw Hill, 2 <sup>nd</sup> Edition, 2010. 2. A.K. Jain, "Fundamentals of Digital Image Processing", PHI, 1 <sup>st</sup> Edition, 1989. 3. Somka, Hlavac, Boyle, "Digital Image Processing and Computer Vision", Cengage Learning, 1 <sup>st</sup> Edition, 2008. 4. Adrain Low, "Introductory Computer vision Imaging Techniques and Solutions", Tata McGraw-Hill, 2 <sup>nd</sup> Edition, 2008. 5. John C. Russ, J. Christian Russ, "Introduction to Image Processing & Analysis", CRC Press, 1 <sup>st</sup> Edition, 2010.		

**Web References:**

1. <https://imagingbook.com/>
2. [https://en.wikipedia.org/wiki/Digital\\_image\\_processing](https://en.wikipedia.org/wiki/Digital_image_processing)
3. <http://www.tutorialspoint.com/dip/>
4. <http://www.imageprocessingplace.com/>
5. <http://web.stanford.edu/class/ee368/>
6. <https://sisu.ut.ee/dev/imageprocessing/book/1>
7. [https://in.mathworks.com/discovery/digital-image-](https://in.mathworks.com/discovery/digital-image-processing.html?requestedDomain=www.mathworks.com)
8. [processing.html?requestedDomain=www.mathworks.com](https://in.mathworks.com/discovery/digital-image-processing.html?requestedDomain=www.mathworks.com)

**E-Text Books:**

1. [http://www.sci.utah.edu/~gerig/CS6640-F2010/dip3e\\_chapter\\_02.pdf](http://www.sci.utah.edu/~gerig/CS6640-F2010/dip3e_chapter_02.pdf)
2. <http://www.faadooengineers.com/threads/350-Digital-Image-Processing>
3. <http://newwayofengineering.blogspot.in/2013/08/anil-k-jain-fundamentals-of-digital.html>
4. <http://bookboon.com/en/digital-image-processing-part-one-ebook>