

IMAGE PROCESSING

V Semester: CSE								
Course Code	Category	Hours /Week			Credits	Maximum Marks		
AECC26	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45		Tutorials Classes: Nil		Practical Classes: Nil			Total Classes: 45	
Prerequisite: There is no prerequisite to take this course								
I. COURSE OVERVIEW:								
<p>The primary objective of this course is to introduce the concept of image processing techniques as a precise digital component with mathematical and signals concepts, and study on various techniques in the creation of digital model of the image, enhancement of quality, image restoration and compression and color models. The course consists of a strong mathematical component to process in spatial and frequency domains on gray and color images.</p>								
II. COURSE OBJECTIVES:								
The students will try to learn:								
<ul style="list-style-type: none"> I The fundamental concepts of digital image processing system and its components. II The image enhancement, segmentation and compression techniques in spatial and frequency domains. III The processing steps included in colour image model construction and enhancement. IV The algorithms used to solve image processing problems to meet design specifications of various applications like Industry, medicine and defence. 								
III. COURSE OUTCOMES:								
After successful completion of the course, students should be able to:								
CO 1	Interpret the principles and terminology of digital image processing for describing the features of image.			Understand				
CO 2	Illustrate mathematical tools used in image intensity transformations for quality enhancement.			Understand				
CO 3	Identify image enhancement technique to improve the quality.			Apply				
CO 4	Apply filters on spatial and frequency domains for restoring and reducing the noise in a given image.			Apply				
CO 5	Summarize color models and transformation processing techniques for color image enhancement and compression			Understand				
CO 6	Apply region based morphological operations and edge- based image segmentation techniques for detection of objects in images to remove the imperfections in the structure of the image.			Apply				
IV. COURSE SYLLABUS								
MODULE –I: INTRODUCTION (10)								
<p>What is digital image processing, origins of digital image processing, examples of fields that use dip, fundamental steps in digital image processing, components of an image processing system; Digital image fundamentals: Elements of visual perception, a simple image formation model, basic concepts in sampling and quantization, representing digital images, spatial and gray-level resolution, zooming and shrinking digital images, some basic relationships between pixels, linear and nonlinear operations.</p>								
MODULE –II: IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN(10)								
<p>Some basic gray level transformations, histogram processing, enhancement using arithmetic/logic operations, basics of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods. Introduction to the Fourier transform and the frequency domain, smoothing frequency domain filters, sharpening frequency domain filters, homomorphic filtering.</p>								
MODULE –III: IMAGE RESTORATION AND FILTERING(08)								
<p>A model of the image degradation/restoration process, noise models, restoration in the presence of noise only spatial filtering, periodic noise reduction by frequency domain filtering.</p>								

Linear position invariant degradations, estimating the degradation function, inverse filtering, minimum mean square error (wiener) filtering, constrained least square filtering, and geometric mean filter.

MODULE –IV: COLOR IMAGE PROCESSING (10)

Color models, pseudo color image processing, basics of full-color image processing, color transformations, smoothing and sharpening, color segmentation, noise in color images, color image compression; Wavelets and multi resolution processing: Image pyramids, sub band coding, the haar transform, multi resolution expansions, wavelet transforms in one dimension, fast wavelet transform, wavelet transforms in two dimensions, wavelet packets; Fundamentals, image compression models, error-free (lossless) compression, lossy compression.

MODULE -V SYSTEM DESIGN TECHNIQUES (07)

Preliminaries, dilation and erosion, opening and closing, the hit-or-miss transformation, some basic morphological algorithms; Image segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region-based segmentation.

V. TEXT BOOKS:

1. Rafael C Gonzalez, Richard E. Woods, “Digital Image Processing”, PHI, 2nd Edition, 2005.

VI. REFERENCE BOOKS:

1. K. Jain, “Fundamentals of Digital Image Processing”, Pearson, 3rd Edition, 2004.
2. Scott. E. Umbaugh, “Digital Image Processing and Analysis”, CRC Press, 2nd Edition, 2014.
3. S. Jayaraman, S. Esakkirajan, T.Veerakumar, “Digital Image Processing”, McGraw-Hill Education. (India) Pvt. Ltd., 2013.

VII. WEBREFERENCES:

1. http://www.efunda.com/math/math_home/math.cfm.
2. <http://www.ocw.mit.edu/resources/#Mathematics>.
3. <http://www.sosmath.com/>.
4. <http://www.mathworld.wolfram.com/>.

