ADVANCES IN DIGITAL IMAGE PROCESSING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	**16SCS151**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- Demonstrate the image segmentation and representation techniques.
- How image are analyzed to extract features of interest.
- Introduce the concepts of image registration and image fusion.
- Analyze the constraints in image processing when dealing with 3D data sets.

Module 1	**Teaching Hours**
Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing,	**8 Hours**

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.	
Module 2	
Image Enhancement in the Spatial Domain: 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. Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.	**8 Hours**
Module 3	
Image Restoration: A Model of the Image degradation/Restoration process, Noise	**8 Hours**
Models, Restoration in the Presence of Noise Only– Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter.	
Module 4	**8 Hours**
Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. Wavelets and Multiresolution Processing: Image Pyramids, Subband coding, The Haar Transform, Multiresolution Expansions, Wavelet Transforms in one Dimension, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. Image Compression: Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression	
Module 5	**8 Hours**
Morphological Image Processing: 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.	
Course Outcomes	
The students should be able to: • Explain image formation and the role human visual system plays in perception of gray and color image data. • Apply image processing techniques in both the spatial and frequency (Fourier) domains. • Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation. • Conduct independent study and analysis of feature extraction techniques. • Explain the concepts of image registration and image fusion. • Analyze the constraints in image processing when dealing with 3D data sets and to apply image • Apply algorithms in practical applications.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module.	

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

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

Reference Books:

1. S. Sridhar, Digital Image Processing, Oxford University Press India, 2011.
2. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
3. Scott E. Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
4. S. Jayaraman, S. Esakkirajan, T. Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.

Anthony Scime, "Web Mining Applications and Techniques", Idea Group Publishing,2005