EC326: Digital Image Processing

Details of course: -

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Digital Image Processing	3	0	2	Signals and Systems

Course Objective:

1. To make students understand the theoretical foundation of digital image processing concepts.
2. To provide mathematical foundations for digital manipulation of images, image acquisition, preprocessing, enhancement, restoration, morphological operations, and segmentation.
3. To make students learn implementation of algorithms those perform basic image processing operations (e.g., histogram processing, noise removal & image enhancement, and restoration etc.).

Course Outcomes:

CO1:Define two-dimensional signals and systems, image acquisition, sampling, quantization, 2D signals and systems, image transforms, basics of color image processing.
CO2: Explain the mathematical tools used for digital manipulation of images.
CO3: Employ preprocessing, enhancement, filtering, and noise removal techniques.
CO4: Distinguish spatial domain and frequency domain filtering, enhancement, and restoration.
CO5:Evaluate various application specific techniques for enhancement, denoising, morphology, segmentation.
CO6: Develop solutions to real world image processing problems.

S. No.	Content	Contact Hours
Unit 1	Introduction to image processing, Fundamental steps in digital image processing, Concept of visual information, image formation model, Image sampling and quantization. Digital image representation, spatial and grey level resolution, relationship between pixels, Applications of image processing systems. Introduction to various color models: RGB, CMY, CMYK, HSI, HSV, and YCbCr	9
Unit 2	Introduction to Multidimensional signals and systems, 2D-signals, 2D-systems, classification of 2D systems, 2D convolution, 2D Z-transform. Image transform: 2D DFT, discrete cosine, discrete sine, Haar, Walsh, Hadamard, Slant, KL, SVD, Hough, Radon, Ridgelet.	9

Unit 3	Image enhancement: Spatial Domain: linear transformation, image negative, grey level shifting, non-linear transformation, logarithmic transformation, exponential transformation, grey level slicing, bit plane slicing, image averaging, mask processing, histogram manipulations, histogram thresholding, histogram stretching, histogram equalization, noise removing filters, smoothing filters, sharpening filters.	8
Unit 4	Enhancement in frequency domain: ideal low pass filter, Butterworth low pass filter, ideal high pass filter, Butterworth high pass filter, band pass filter, Gaussian filter, homomorphic filtering. Image restoration: degradation model, Noise models, Restoration in presence of noise, Periodic noise removal in frequency domain, Notch filters, Inverse filtering, Wiener Filtering.	8
Unit 5	Introduction to morphological image processing operations, dilation, and erosion, opening and closing, hit-or-miss transformation, boundary extraction, region filling, extraction connected components, convex hull, thinning, thickening, skeletons, pruning. Image segmentation: detection of discontinuities, edge linking and boundary detection, thresholding, region-based segmentation.	8
	Total	42

Books: -

S. No	Name of Books/Authors/Publisher
1	Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing",Pearson Education, 2008, 3rd Edition
2	Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Education, PHI, 2001
3	Rafael C. Gonzalez, Richard E. Woods and Eddins, "Digital Image Processing using MATLAB",McGraw Hill, second, 2013
4	K. R. Castleman, "Digital Image processing", Pearson Education, 2014
5	I. Pitas, "Digital Image Processing Algorithms and Analysis", John Wiley, 2002
6	Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision",Brookes/Cole, PWS Publishing Company, Thomson Learning, 4th Edition