Course Code: CSE4007	Course Title: Digital Image Processing	TPC	3	2	4
Version No.	1.0				
Course Pre-requisites/ Co-requisites/	None				
Anti-requisites (if any).	None				
Objectives:	To enable students to study about digital images and get a first-hand experience on dealing with real world images.				
Expected Outcome:	On the completion of the course, students will be able to: 1. deal with noise using spatial and frequency domain filters. 2. restore image after denoising and deblurring. 3. carry out image compression method. 4. find *region of interest* in images.				
Module No. 1	**Introduction**	**8 Hours**			
Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Spatial Domain Filtering, sampling and quantization.					
Module No. 2	**Spatial Domain Filtering**	**8 Hours**			
Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.					
Module No. 3	**Filtering in the Frequency domain**	**6 Hours**			
Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering.					
Module No. 4	**Image Restoration**	**8 Hours**			
Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections.					
Module No. 5	**Image Compression**	**8 Hours**			
Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Sub-image size selection, blocking artifacts, DCT implementation using FFT, Run length coding, FAX compression (CCITT Group-3 and Group-4), Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation					
Module No. 6	**Image Segmentation**				
Boundary detection-based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation					
Text Books 1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education, Third Edition, 2016.					
References 1. Anil K Jain, "Fundamentals of Digital Image Processing", Springer, Second Edition, 2014.					
	Lab Exercises 1. **Study of different transformation techniques.** 2. **Spatial domain filtering of image.**				

	3. **frequency domain filtering of image.** 4. **Study of sharpening filters.** 5. **Image restoration process.** 6. **Handling noise in image.** 7. **Image compression methods.** **Image segmentation through boundary detection**
Mode of Evaluation	**Practice Tests-20%, Continuous Assessment Tests-60%, Practical Assesment-20%** Practice Tests - Cumulative for 16 Weeks 20% Continuous Assessment Test-1 20% Continuous Assessment Test-2 20% Continuous Assessment Test-3 20% Practical Assessment 20%
Recommended by the Board of Studies on	6.07.2018
Date of Approval by the Academic Council	2nd Academic Council – 21.07.2018