Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code:	**CST557**	**Course:**	**Advanced Digital Image Processing**
L:4Hrs,	**P:0Hrs,**	**Per Week**	**Total Credits: 04**

Course Outcome:

On successful completion of the course, students will be able to:
1. Learn and use different approaches to image enhancement and image analysis.
2. Apply various image segmentation methods with effective object recognition and classification techniques.
3. Understand the need for image transform and compression and able to apply different compression techniques

Syllabus

Introduction:
Intensity transformation functions, Histogram processing, Spatial Filtering: Smoothing and sharpening Frequency Domain Filtering: Smoothing and Sharpening

Image Morphology :
Dilation, Erosion, Opening, Closing, Boundary extraction, Region filling, Hit or Miss Transform, Thinning, Thickening, Skeletonization, Pruning.

Image Segmentation :
Pixel-based methods: thresholds level adjustment, continuity-based methods:-multi-thresholding, detection of regions of interest thresholding and binarization, region growing, watershed algorithm. Edge Detection: Computing the gradient, Roberts, Prewitt, Sobel operators, Second derivative-Laplacian, Canny edge detector, Edge linking-Local processing, Hough transform.

Image Transform: Discrete Sine Transforms, Discrete cosine transforms, Discrete Fourier Transform, Karhunen-Loeve transform, Slant transforms, Walsh-Hadamard transform, Haar Transform.

Image Analysis and Image Registration :
Representation of shapes and contours, shape factors, Fourier descriptors, statistical analysis of texture, Law's measures of texture energy, Fourier domain analysis of texture, structural analysis of texture, Image Registration: Feature Detection, Feature Matching, Transform model estimation, Image Re-sampling and Transformation.

Image Coding and Data Compression: lossy versus lossless compression, distortion measures and fidelity criteria, fundamental concepts of coding (direct source coding, Huffman coding, run-length coding, arithmetic coding, Lempel-Ziv coding, contour coding), the need for decorrelation: transform coding, interpolative coding, predictive coding, compression standards: the jbig standard, the jpeg standard and jpeg 2000.

Object Recognition and Classification:
Patterns and pattern classes, Statistical Decision Making (Bayesian Classifiers), Non-Parametric Decision Making (Histogram based, k Nearest Neighbors), Neural Networks (Single and Multi layer perceptron, Back propagation algorithm).

Video Processing:
Introduction to video signal processing, video processing standards, MPEG block diagram and data flow, MPEG-2 and MPEG-4 standards, motion estimation and compensation algorithms, block matching algorithms, video compression and decompression, interactive video techniques.

Text and Reference Books:
1. Gonzalez and Richard E Woods, Digital Image Processing, Addison-Wesley, 2000 3rd Edition
2. S Jayaraman, S Esakkirajan , Digital Image Processing, McGraw Hill Education.
3. Barbara Zitova, Jan Flusser Image registration methods: a survey Image and Vision Computing 21 (2003) 977–1000 Elsevier journal.
4. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision,Brooks, 1999
5. Gonzalez, Steven Eddins and Richard E Woods, Digital Image Processing using MATLAB, Prentice-Hall, 2000 3rd Edition.
6. Anil K Jain, Fundamentals of Digital Image Processing, Prentice-Hall India, 2001.

Reasons for Revision:

1. Introduction of Digital Image Processing is added since some students are not known with basic concepts.
2. Edge detection is a part of image segmentation so included in that portion.
3. Image Analysis modified including concepts of image registration in it.
4. Image Transform is separate topic which was previously included in segmentation.
5. List of Text and Reference books modified.

Course Co-ordinator: Prof. D. Borikar/ Ms. J. Sanghavi