Name of the Course: Image and Video Processing
Undergraduate: Code-IIVP632C
Postgraduate: Code-IIVP240E

Digital Image Fundamentals- Simple image model, digital image formation, sampling, quantization, resolutions and representation, relationship among pixels, types of digital images. Color Image Processing: Color Representation, Chromaticity Diagram and Color Spaces, types of digital imaging and application areas. Enhancement- Point Processing: Contrast Stretching, Power-law and Gamma Transformation. Histogram Processing: Histogram Equalization and Matching. Filtering and Restoration- Degradation function and Noise Models, Spatial Domain Filtering: Correlation and Convolution, Smoothing Linear and Nonlinear Filters: Mean and Median Filters, Adaptive Filtering, Sharpening Linear and Nonlinear Filters: Derivative, Laplacian, Unsharp Masking, High-boost Filtering. Frequency Domain Filtering: Filtering: Low-pass (Smoothing) & High-Pass (Sharpening) Ideal, Butterworth and Gaussian Filtering, Unsharp Masking and High-Boost Filtering, Homomorphic Filtering, Periodic Noise Reduction and Inverse Filtering & Wiener Filtering. Edges, Lines and Boundary Detection- First and Second Order Edge Operators, Multi-scale Edge Detection, Canny Edge Detection Algorithm, Hough Transform: Line and Edge Detection, Morphological Operations and Application: Boundary, Skelton, Convex-Hull, Thinning, Pruning etc. Segmentation & Feature Extraction: Model-based and probabilistic methods and Image Classification Optimal and Multilevel Thresholding, Gray Image Segmentation, Watershed Algorithm. Compression: Lossy and Lossless compression techniques, JPEG JPEG2000 and Variants, Introduction to video processing, Compression standards and formats, Video Streaming.

Text Books:
1. Digital Image Processing (3rd Edition) by Gonzalez, R. C. and Woods, R. E., *PHI*
2. Digital Image Processing (3rd Edition) by Willam K. Pratt, John Willey & Sons

Name of the Course: Computer Vision
Under Graduate: Code-ICV730E
Post Graduate: Code-ICV340E

Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing. **Depth estimation and Multi-camera views:** Perspective, Binocular Stereopsis, Camera and Epipolar Geometry, Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework, Auto-calibration. **Feature Extraction:** Edges -Canny, LOG, DOG, Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. **Image Segmentation:** Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation, Object detection. **Pattern Analysis:** Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised, Classifiers: Bayes, KNN, ANN models, Dimensionality Reduction: PCA, LDA, ICA, Non-parametric methods. **Motion Analysis:** Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo, Motion parameter estimation. **Shape from X:** Light at Surfaces, Phong Model, Reflectance Map, Albedo estimation, Photometric Stereo, Use of Surface Smoothness Constraint, Shape from Texture, color, motion and edges. **Others & Applications:** CBIR, CBVR, Activity Recognition, Biometrics, Tracking, Stitching and Document Processing, Augmented Reality, Cognitive models in Computer Vision.

Text Books:
(a). Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
(b). Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003