# EE 414: Digital Image Processing (3-0-0:3)

**Digital image fundamentals:** Visual perception, image sensing and acquisition, sampling and quantization, basic relationship between pixels and their neighborhood properties.

**Image enhancement in spatial domain:** Gray-level transformations, histogram equalization, spatial filters-averaging, order statistics.

**Edge detection:** first and second derivative filters, Sobel, Canny, Laplacian and Laplacian-of Gaussion masks.

**Image filtering in frequency domain:** One and two-dimensional DFT, properties of 2-D DFT, periodicity properties, convolution and correlation theorems, Fast Fourier Transforms, Smoothing and sharpening filtering in frequency domain, ideal and Butterworth filters, homomorphic filtering.

**Image restoration:** Degradation/ restoration process, noise models, restoration in presence of noise-only spatial filtering, linear position-invariant degradations, estimating the degradation function, inverse filtering, Wiener filtering, constrained least squares filtering, geometric transformations.

**Color image processing:** Color models RGB, HSI, YUV, pseudo-color image processing, full-color image processing, color transformation, color segmentation, noise in color images.

**Morphological Image Processing:** Basic operations- dilation, erosion, opening, closing, Hit-Miss transformations, Basic morphological algorithms- boundary extraction, region filling, connected components, convex hull, thinning, thickening, skeletons, pruning, extensions to gray-scale morphology.

**Image segmentation:** Edge linking and boundary detection, Hough transforms, graph-theoretic techniques, global and adaptive thresholding, Region based segmentation, Segmentation by morphological watersheds, motion based segmentation.

**Texture Analysis:** Cooccurrence matrix, Gabor filter.

**Representation and Description:** Boundary description (Shape,Texture, Motion, Color Descriptors etc), Regional description (Fourier Descriptors, Shape Number etc)

**Text Books:**


1. Rafael C Gonzalez and Richard E Woods, “Digital Image Processing”, Pearson Education
2. William K Pratt, “Digital Image Processing”, John Willey


**References:**


1. A. K. Jain, “Fundamentals of Digital Image Processing”, PHI, New Delhi
2. Chanda Dutta Magundar, “Digital Image Processing and Applications”, PHI
3. C. Phillips, “Image Processing in C”, BPB Publication
4. B. Chanda, D. Dutta Majumdar, “Digital Image processing”, PHI