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Course Co-ordinated by *IIT Kanpur*

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## Coordinators



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### Syllabus

### References

#### Module – 1

- Introduction
- Digital Image definitions
  - o Common Values
  - o Characteristics of Image Operations
- Types of Operations
- Types of neighbourhoods
  - o Video parameters
- Tools
  - o 2D convolution
  - o Properties of 2D convolution
  - o 2D Fourier Transforms
  - o Properties of 2D Fourier Transforms
- Importance of phase and magnitude
- Circularly Symmetric Signals
- Examples of 2D Signals and transforms.
  - o Statistical Description of Images
- Perception
  - o Brightness Sensitivity
- Wavelength Sensitivity
- Stimulus Sensitivity
  - o Spatial Frequency Sensitivity
  - o Psychophysics of Color vision
- Perceived color
- Color metrics
- CIE chromaticity coordinates
- Spatial effects in color vision
  - o Optical illusions.

#### Module 2

- Image Sampling
  - o Two dimensional Sampling theory.
  - o Extensions of sampling theory
- Non rectangular Grid sampling
- Hexagonal sampling
- Optimal sampling
- Image Quantisation
  - o The optimum Mean Square Lloyd-Max quantiser
  - o Optimum mean square uniform quantiser for non uniform densities
  - o Analytic Models for practical quantisers.
  - o Visual quantisation
  - o Vector Quantisation

#### Module 3

- Image Transforms
  - o Two dimensional orthogonal and unitary transforms
- Separable unitary transforms
- Basis images
- Dimensionality of Image Transforms
  - o Discrete linear orthogonal
- DFT, WHT, KLT, DCT and SVD.
- Quantisation of Transform coefficients.
- Transform Coding of Color images.

#### Module 4

- Image Enhancement
  - o Contrast and dynamic Range Modification
- Histogram-based operations
  - o Smoothing operations
  - o Edge Detection-derivative based operation
  - o Image Interpolation and Motion Estimation
  - o Pseudocoloring.

**Module 5**

- Image Restoration
  - o Degradation Estimation
  - o Reduction of Additive Noise
  - o Reduction of Image Blurring
  - o Simultaneous reduction of noise and blurring
  - o Reduction of Signal dependent noise
  - o Temporal filtering for Image Restoration
  - o Extrapolation of Band limited Signals.

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