# 22AM304 FUNDAMENTALS OF IMAGE PROCESSING

Hours Per Week :

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 3 |

**PREREQUISITE KNOWLEDGE:** Probability & Statistics.

**COURSE DESCRIPTION AND OBJECTIVES:**

This course focuses on imparting knowledge about the aspects of Image Processing and itsapplications. The main objective of the course is to learn digital image fundamentals, image transforms, image enhancement, restoration and compression, morphological image processing, representation and description.

## MODULE-1

**UNIT-1** **8L+0T+8P=16 Hours**

**FUNDAMENTALSOFIMAGEPROCESSING:**

Fundamental steps in digital image processing, Components of image processing system, A simple image formation model, Image sampling and quantization, Basic relationships between pixels, Introduction to Fourier Transform and DFT–properties of 2D Fourier Transform, FFT.

**UNIT-2** **8L+0T+8P=16 Hours**

**IMAGEENHANCEMENT:**

**Basic Gray:** level transformations, Histogram processing, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

**Image Segmentation:** Fundamentals, Point, Line and edge detection, thresholding, Region-based segmentation, Segmentation using morphological water sheds, the use of motion in segmentation.

**PRACTICES:**

- Develop a module to enhance the image by using image arithmetic and logical operations.
- Develop a module for an image enhancement using kernel operations.
- Develop a module for gray level slicing with and without background.
- Develop a module for image enhancement using histogram equalization.
- Develop a module to filter an image using low pass & high pass filter in spatial domain. Compare the performance of both filters.
- Develop a module for smooth an image using low pass &high pass filters in frequency domain. Compare the performance of both filters.
- Develop a module for detecting lines &edges in an image.
- Develop a module for segmenting region of interest.

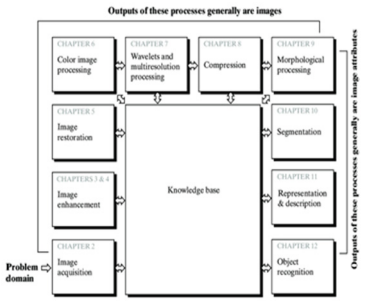
## MODULE-2

**UNIT-1** **8L+0T+8P = 16 Hours**

**IMAGE RESTORATION:**

A model of image degradation/restoration, Noise models, inverse filtering, wiener filtering, Constrained Least Squares Filtering, Geometric Mean Filter.

**Image Compression:** Fundamentals, Huff man coding, Golomb coding, LZW coding, Run-length coding.




Source: https://snabaynetworking.com/what-is-computer-network-and-its-types/

**SKILLS:**

- ✓ *Apply knowledge of science and engineering principles to image related problems.*
- ✓ *Undertake image problem identification and formulate solutions.*
- ✓ *Implement algorithms for enhancement, restoration, compression etc.*

**UNIT-2** **8L+0T+8P=16 Hours**

**MORPHOLOGICAL IMAGE PROCESSING:**

Erosion, Dilation, Opening, Closing, the hit-or-miss transformation; Basic morphological algorithms-boundary extraction, hole filling, extraction of connected components, thinning, thickening, skeletons, pruning.

**Feature Extraction:** Background, Boundary preprocessing, Boundary Feature Descriptors, Region Feature Descriptors, Principle Components as feature descriptors, Whole-image features.

**PRACTICES:**

- Develop a module to perform add & removal of salt and pepper noise. Compute PSNR & MSE and check the impact before and after removal of noise.
- Develop a module to remove noise using average filter and median filter. Compute PSNR & MSE before and after removal of noise.
- Develop a module for image compression and decompression.
- Develop a module for morphological image operations -erosion, dilation, opening & closing.
- Develop a module for morphological image operations - hit-or-miss transformation
- Develop a module formorphologicalimageoperations - thinning, thickening
- Develop a module for extracting boundary features of an image.
- Develop a module for extracting features of an image using GLCM.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to:

| CO No. | Course Outcomes | Blooms Level | Module No. | Mapping with POs |
|---|---|---|---|---|
| 1 | Understand the fundamental concepts of a digital image processing system | Understand | 1 | 1, 2 |
| 2 | Learn different techniques employed for the enhancement of images. | Analyse | 1 | 1, 2, 3, 5, 12 |
| 3 | Employ image segmentation and representation techniques to extract region of interest | Apply | 1 | 1, 2, 3, 5, 12 |
| 4 | Learn different causes for image degradation and overview of image restoration techniques. | Evaluate | 2 | 1, 2, 3, 5, 12 |
| 5 | Apply various compression techniques to reduce image size and morphological operations to extract features. | Apply | 2 | 1, 2, 3, 5, 12 |
| 6 | Learn different feature extraction techniques for image analysis and recognition | Apply | 2 | 1, 2, 3, 5, 12 |

**TEXT BOOK:**

1. Rafeal C.Gonzalez and Richard E.Woods, “Digital Image Processing”, 4thEdition, Pearson Education/PHI, 2018.

**REFERENCE BOOKS:**

1. Milanson ka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis and Machine Vision”, 4thEdition, C engage, 2015.
2. A lasdair Mc Andrew, “Introduction to Digital Image Processing with Mat lab”, Thomson Course Technology, 2004 Course Technology Press, Boston, MA, United States, 2004.
3. William K. Prat, “Digital Image Processing”, 4thEdition, Wiley-Inter science, A John Wiley & Sons, Inc., Publication, 2007.