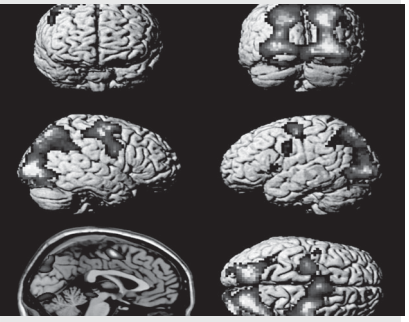

16BM402 MEDICAL IMAGE PROCESSING

Hours Per Week :

L	T	P	C
3	1	2	5

Total Hours :

L	T	P
45	15	30

WA/RA	SSH/HSH	CS	SA	S	BS
20	48	6	12	3	2

Course Description and Objectives:

This course offers the working knowledge of digital image processing, various techniques of transformation, enhancement, restoration, compression, segmentation and image morphology. The objective of the course is to provide the understanding of all kinds of image processing in biomedical applications.

Course Outcomes:

The student will be able to:

- understand in the science of images and image processing, including mathematical transforms
- use techniques of Digital Image Processing, including Image Enhancement in the Spatial and Frequency Domain, Compression, Morphology and Segmentation.

SKILLS:

- ✓ *Process medical images using different techniques.*
- ✓ *Diagnose abnormalities in a given health problem relative to imaging.*
- ✓ *Gain knowledge to write or device their own model for specifically pertaining problems*
- ✓ *Critically understand the mathematics behind image processing.*

UNIT - 1 **L-10, T-3**

INTRODUCTION: Digitized image functions, Dirac distributions, Convolution, Fourier transform, Images as linear system; Image digitization, sampling, Quantization, Color images; Digital image properties, Metric and topological properties, Histogram visual perception, Image quality, Noise,Data structures for image analysis, Data representation, Traditional and hierarchical data structures.

UNIT - 2 **L-9, T-3**

IMAGE ENHANCEMENT: Contrast manipulation, histogram equalization, Laplacian derivatives, Sobel and Kirsch operators, Rank operators, Textural analysis, Image preprocessing – pixel brightness transformations, Geometric transformations, local preprocessing, Image restoration, Imaging filters.

UNIT - 3 **L-8, T-3**

THRESHOLDING AND SEGMENTATION: Detection methods, Optimal thresholding, Multi-spectral thresholding; Edge based segmentation, Region based segmentation, Matching, Advanced optimal border and surface detection approaches.

UNIT - 4 **L-9, T-3**

RESTORATION: Deterministic, Geometric linear filtration, Inverse filtering, Power spectrum Equalization, stochastic; Wiener filtering, Registration, Anatomy based, Object based, Scene based.

UNIT - 5 **L-9, T-3**

MATHEMATICAL MORPHOLOGY: Basic morphological concepts, Morphological principles: Binary dilation and erosion, Gray scale dilation and erosion, skeletons and object marking, graundometry, Morphological segmentation and water sheds; Applications of image processing techniques to MRI Images, Dicom, CT and Functional MRI images.

ACTIVITIES:

- *Histogram equalization of an image.*
- *Segmentation mechanisms.*
- *Noise reduction using different filters.*
- *Pixel brightness transformation and thresholding*
- *Image markings, segmentation and registration of images.*

LABORATORY EXPERIMENTS

Course Outcomes:

student should be able to:

- perform filtering operations in the image
- use transforms and analyse the characteristics of the image.
- write program to analyse the texture of the image.
- implement project on simple image processing applications.
- apply image processing technique to solve real world problems

LIST OF EXPERIMENTS: Total hours: 30

Simulation using MATLAB (Image processing Tool Box) or equivalent software

1. Image sampling and quantization
2. Analysis of spatial and intensity resolution of images.
3. Intensity transformation of images.
4. DFT analysis of images
5. Transforms (Walsh, Hadamard, DCT, Haar)
6. Histogram Processing

7. Image Enhancement-Spatial filtering
8. Image Enhancement- Filtering in frequency domain
9. Image segmentation – Edge detection, line detection and point detection
10. Basic Morphological operations.
11. Basic Thresholding functions
12. Analysis of images with different color models.
13. Analysis of medically acquired images.

TEXT BOOKS:

1. John C Russ, “The image processing handbook”, CRC and IEEE press, 1999.
2. Craig A.Hindley, “Practical image processing in C”, John Wiley and Sons, 1991.

REFERENCE BOOKS:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image processing, analysis and machine vision, 2nd edition,Brooks/Cole publishing Co., 1999.
2. Jayaram, Kudupa and Gabor, “T Herman, 3D imaging in medicine”, 2nd edition, CRC press, 2000.
3. Rafael C, Gonzalez, Richard E. Woods, Steven Eddins, “Digital Image Processing using MATLAB” , Pearson Education, Inc., 2004.