

**SHRI SANT GAJANAN MAHARAJ COLLEGE OF  
ENGINEERING, SHEGAON**

**Lesson plan**



**B. E. (Electronics & Telecom. Engineering)**

**Semester: Seventh, Autumn-2021-22**

**Digital Image Processing, Code: 7ET2**

**4U1 and 4U2**

Subject Teacher: Manish N. Tibdewal

**Department of Electronics and Telecommunication Engineering  
S.S.G.M.C.E., SHEGAON**

Session- 2020-21

## **Introduction:**

The growth of digital image processing has been fueled by technological advances in digital imaging, computer processors and mass storage devices. The interest in this field stems from two principal application areas: processing of pictorial information for human interpretation and processing of information for storage, transmission and machine perception. Several new technological trends promise to further stimulate the growth in this field. The usage of digital image processing in commercial, office automation, industrial and medical field has a steady growth.

Digital Image Processing has experienced a phenomenal growth in both scope and application in last few decades. In the era of digital systems development of internet and possibilities of share of information by people from different locations of the world, made the computer imaging subject amusing and exciting. In spite of internet, with the growth of computer hardware technologies and increasing computer power, it became possible to send and receive complex data over internet.

In earlier times, while only written texts could have been sending by fax, later it was possible to send and receive every kind of pictures or photographs. This kind of visual information should be converted to digital image format for transmission. This method has taken place in the modern age, as being the best transmission method and will stay there by still growing up.

## **Objectives:**

This subject gives an overview of digital image processing and covers principal approaches used in processing of image. The basic purpose of the subject is to understand and process image as a function. Different elements of image processing like image acquisition, sampling, and quantization are uncovered in this subject. Spatial as well as transform domain enhancement techniques are also outlined to improve image in a predefined sense. The subject also deals with different techniques in image segmentation and object recognition required for machine perception.

With a distinction between human and computer visual systems, computer-imaging subjects may be divided up two main groups: computer vision and image processing. While computer vision applications are interested in interpretations of images by computers, on the other hand image processing is interested in interpretation of images by human vision systems. There can be some limitations or superiorities between human and computer vision systems. Researchers studying on computer imaging should be aware of these differences.

## Course Outcomes:

After the successful completion of the course student is able to:

1. to understand the general terminology and basics of digital image processing, Elements of Visual Perception, image sampling and quantization etc., Examine various types of images.
2. to analyze and implement digital image processing algorithms. Develop spatial filtering and other filtering techniques for preprocessing of images.
3. to analyze and implement the intensity transformations and various image transforms, Fourier transform for image processing in frequency domain and filtering techniques in Fourier Domain.
4. to evaluate and design the methodologies for image segmentation, Compression and restoration etc. Also design Image processing techniques with practical approach.

After completion of the course student will be capable of working in various images processing application areas are including such as:

- Image enhancement in time and frequency domain
- Image Segmentation and Feature Extraction
- Image Morphology and Recognition
- Medical Image Processing
- Motion Analysis
- Satellite Image Processing
- Radar Imaging, etc.

B. E. (Electronics and Telecom. Engg.) Semester: **Seventh**

## Syllabus

### Digital Image Processing

Subject Code : **7ET2**

#### Section A

#### UNIT I

**Introduction to digital image processing:**

Digital Image Fundamentals, Elements of Visual Perception, Simple Image Model, Sampling and Quantization, Basic Relationships between Pixel Imaging Geometry, Gray scale image representation

#### UNIT II

**Image Transforms:** Introduction to the Fourier Transform, DFT, Properties of Two-Dimensional Fourier Transform, FFT, Hadamard, Harr, DCT, Slant Transform.

#### UNIT III

**Image Enhancement:** Basic Techniques, Enhancement by point processing, Spatial Filtering, Enhancement in Frequency domain, histogram-based processing, Homomorphic filtering.

## Section B

### UNIT IV

**Image Restoration:** Degradation model, Diagonalization concept, Algebraic approach to Restoration. Inverse filtering, Wiener (CNS) filtering, Restoration in Spatial domain, Basic morphological concept, morphological principles, binary morphology, Basic concepts of erosion and dilation

### UNIT V

**Image Compression:** Fundamentals, Image compression models, Elements of Information theory, Lossy and predictive methods, vector quantization, Run-length coding, Huffman coding, and lossless compression, compression standards.

### UNIT VI

**Image Segmentation:** Detection of discontinuities, Edge Linking and boundary detection, Thresholding, Regional oriented Segmentation.

### Magazines/Journals/Transactions:

1. IEEE transactions on Image Processing, A publication of the IEEE signal processing society, monthly.
2. IET Image Processing, A publication of the Institution of Engineering and Technology, monthly.
3. IEEE Transactions on Multimedia published by the Institute for Scientific Information, monthly.
4. IEEE Multimedia, A publication of IEEE Computer Society, monthly.
5. IEEE Transactions on Circuits and Systems for Video Technology, IEEE Circuits and Systems Society, Monthly.

**B.E. (Electronics & Telecom. Engg.) Semester: Seventh**

**Subject: Digital Image Processing**

**Code: 7ET2**

Subject Teacher : Manish N. Tibdewal

**Total Lectures : 52**

Lect. No.	Topics to cover	Text Book	Ref. Book	UNIT
1.	Importance of the subject. Fundamentals of Digital image processing. Introduction to syllabus, Reference/Text books	1	2	1
2.	Applications of Digital Image Processing.	1	2	1
3.	Basic Steps involved in image processing and Image acquisition.	1	2	1
4.	Elements of Visual Perception	1	2	1
5.	Human Visual system	1	2	1
6.	Image types, Image Processing Standards and Formats	1	3	1
7.	Sampling and Quantization	1	3	1
8.	Basic Relationships between Pixel Imaging Geometry	2	1	1

9.	Understanding pixel neighborhood Pixel Relationship and Distance measure	2	1	1
10.	Gray scale Image Representation	2	1	1
11.	Image Transforms: Need, types, 2D DFT	2	1	2
12.	Properties of 2D DFT	2	1	2
13.	Hadamard transform and its Representation	1	3	2
14.	Hadamard transform and its Representation cont.	1	3	2
15.	Haar Transform and its Representation	2	1	2
16.	Haar Transform and its Representation cont.	2	1	2
17.	Discrete cosine transform	2	1	2
18.	Slant transform and its Representation	2	1	2
19.	Slant transform and its Representation cont.	2	1	2
20.	Image Enhancement and Types of point operations	1	2	3
21.	Image enhancement in spatial domain, Negative, Gray level transform, Gray level slicing	1	3	3
22.	Histogram Manipulation, Image adjustment operations	2	1	3
23.	Arithmetic operations, Logical operations	2	1	3
24.	Filtering in spatial domain: Median filter	1	3	3
25.	Filtering in Frequency domain	2	1	3
26.	Enhancement in Frequency domain	2	1	3
27.	Homomorphic filtering	1	3	3
28.	Image Restoration and Denoising: Image degradation models	2	2	4
29.	Wiener Filtering	2	2	4
30.	Inverse Filtering	2	1	4
31.	Restoration in Spatial domain	2	2	4
32.	Basic morphological concept,	2	2	4
33.	Morphological techniques, Structuring element	2	1	4
34.	Binary morphology	2	2	4
35.	Basic concepts of erosion and dilation	2	2	4
36.	Applications of various types of Morphological Operations	2	1	4
37.	Fundamentals, Image compression models	2	1	5
38.	Image Compression need, Redundancy, and types	2	1	5
39.	Numerical on Image compression algorithms	2	1	5
40.	Vector quantization techniques	2	1	5
41.	Lossless Huffman coding,	2	1	5
42.	Run-length coding	1	2	5
43.	Block coding techniques	2	1	5
44.	Compression standards	1	2	5
45.	Image segmentation Techniques	2	1	6
46.	Image segmentation based on thresholding	2	2	6
47.	Edge-based segmentation	2	1	6
48.	Edge detection,	2	1	6

49.	Edge linking	2	1	6
50.	Boundary detection	2	1	6
51.	Shape representation and classification.	2	1	6
52.	Region approach to image segmentation	2	1	6

### **Coverage beyond the Syllabus:**

Applications of Image processing in the following areas:

- Biomedical Image processing and types,
- Satellite Imaging,
- Face Recognition, Iris Recognition,
- Finger Print Recognition,
- Biometrics Image processing,
- Imaging in Robotics,
- Optical Character Recognition system,
- Cryptography, Steganography,
- Machine vision and Expert systems, and
- Other image processing applications, etc.

### **Text Books :**

- 1)'Digital Image Processing' By R.C Gonzales & Woods –Addison Wesley IIIrd Ed
- 2)'Digital Image Processing' by S Jayaraman, S Esakkirajan, T Veerakumar -Tata Mc-Graw Hill.

### **Reference Books:**

- 1) 'Fundamental Digital Image Processing' by A.K.Jain –Prentics Hall Inc.
- 2) 'Digital Image Processing' By W.K Pratt IIIrd ed John Wiley
- 3) 'Digital Image Processing and Analysis' by B Chanda and D. Mujumdar-PHI New Delhi.

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-- M. N. Tibdewal