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| <b>Subject Code:</b> 1RI3000102 | <b>Subject Title:</b> Essentials of Disciplinary Research Subject-1<br>(Digital Image Processing-1) |
| <b>Pre-requisite Subject</b>    |                                                                                                     |

### Objectives of course:

The objectives of the course are to:

- Understand basic concepts and methodologies for digital image processing
- Develop a foundation that can be used as the basis for further study and research in this field
- Provide understanding of the different types of image representations, enhancing, Image characteristics, image filtering etc

### Learning outcomes:

At the end of this course, the student would be able

- Understand image representation.
- Enhance image quality using image enhancement techniques.
- Filter given image using frequency domain filtering technique.

| Teaching Scheme ( Credit Distribution) |          |           |        | Evaluation Scheme(% Marks)       | Total Marks |
|----------------------------------------|----------|-----------|--------|----------------------------------|-------------|
| Lecture                                | Tutorial | Practical | Credit | Continuous (Internal) Assessment | 100         |
| 3                                      | 1        | --        | 4      | 100%                             |             |

| Unit | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Lecture | Wt. (%) |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|
| 1    | <b>Digital Image Fundamentals</b><br>Light, brightness adaption and discrimination, Human visual system, Image as a 2D data, Image representation Gray scale and Colour images, Image sampling and quantization                                                                                                                                                                                                                                                   | 3       | 25      |
| 2    | <b>Image enhancement and filtering in spatial domain</b><br>Intensity transformation functions: Contrast stretching, Thresholding, Image negative, Log transformation, Power-law transformation, Intensity level slicing and Bit-plane slicing. Image histogram, Histogram equalisation process. Fundamentals of spatial filtering, Correlation and convolution, Spatial filtering mask for low pass filtering (smoothing) and high pass filtering (sharpening).  | 4       | 25      |
| 3    | <b>Image enhancement and filtering in spatial domain:</b><br>Intensity transformation functions: Contrast stretching, Thresholding, Image negative, Log transformation, Power-law transformation, Intensity level slicing and Bit-plane slicing. Image histogram, Histogram equalisation process. Fundamentals of spatial filtering, Correlation and convolution, Spatial filtering mask for low pass filtering (smoothing) and high pass filtering (sharpening). | 4       | 25      |
| 4    | <b>Image filtering in the frequency domain:</b><br>Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering, 2D- DFT, 2DFFT, 2D-DCT, Fundamentals of 2D-wavelet transform, Image pyramids, sub-band coding.                                                                                                                                                                                        | 4       | 25      |

**List of References:**

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Third Edition, Pearson Education
2. Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill Publication
3. Digital Image Processing, S Sridhar, Oxford University Press.

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| <b>Subject Code:</b> 1RI3000103 | <b>Subject Title:</b> Essentials of Disciplinary Research Subject-2<br>(Digital Image Processing-2) |
| <b>Pre-requisite Subject</b>    | - NONE -                                                                                            |

### Objectives of course:

The objectives of the course are to:

- Understand basic concepts and methodologies for digital image processing
- Develop a foundation that can be used as the basis for further study and research in this field
- Provide understanding of image restoration ,image compression, image segmentation etc

### Learning outcomes:

At the end of this course, the student would be able

- Select the right image restoration technique to remove degradation from given image.
- Represent image using minimum number of bits using image compression.
- Understand image segmentation technique.
- Do morphological operations on given image.

| Teaching Scheme ( Credit Distribution) |          |           |        | Evaluation Scheme(% Marks)       | Total Marks |
|----------------------------------------|----------|-----------|--------|----------------------------------|-------------|
| Lecture                                | Tutorial | Practical | Credit | Continuous (Internal) Assessment | 50          |
| ---                                    |          |           | 2      | 100%                             |             |

| Unit | Content                                                                                                                                                                                                                                                                                              | Wt. (%) |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 1    | <b>Image restoration:</b><br>Reasons for image degradation, Model of image degradation/restoration process, Noise probability density functions, Image restoration using spatial filtering (Mean filters, Order statistic filters and adaptive filters), Inverse Filtering, MMSE (Wiener) Filtering. | 20      |
| 2    | <b>Colour Image Processing:</b><br>Colour Fundamentals, Colour Models, Pseudo-colour image processing.                                                                                                                                                                                               | 20      |
| 3    | <b>Image Compression:</b><br>Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard, Wavelet based image compression                                                                                                      | 20      |
| 4    | <b>Image Segmentation:</b><br>Edge based segmentation, Region based segmentation, Region split and merge techniques, Region growing by pixel aggregation, optimal thresholding.                                                                                                                      | 20      |
| 5    | <b>Morphological Image Processing:</b><br>Basic morphological operations, Erosion, dilation, opening, closing, Structuring elements, Hit-or-Miss transform, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons, Reconstruction by erosion and dilation          | 20      |

**List of References:**

Reference Books:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Third Edition, Pearson Education
2. Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill Publication
3. Digital Image Processing, S Sridhar, Oxford University Press.