Course Title: Digital Image Processing

Semester and Year: B.Tech. Vth Semester and B.Tech. VIIth Semester

Credit Structure(L-T-P-Cr): 3-0-2-4

Course Code: IE404

Prerequisites (if any): Programming Experience

Instructor’s Name with email: Manish Khare (manish_khare@daiict.ac.in)

Course Descriptions:

This course is an introduction to the fundamental concepts and techniques in basic digital image processing and their applications to solve real life problems. The topics covered include Digital Image Fundamentals, Image Transforms, Image Enhancement, Restoration and Compression, Morphological Image Processing, Nonlinear Image Processing, and Image Analysis. Application examples are also included. Upon completion of this course, students will be familiar with basic image processing techniques for solving real problems. Student will also have sufficient expertise in both the theory of two-dimensional signal processing and its wide range of applications, for example, image restoration, image compression, and image analysis.

Course Objectives:

• Describe and explain basic principles of digital image processing.
• Design and implement algorithms that perform basic image processing
• Design and implement algorithms for advanced image analysis
• Assess the performance of image processing algorithms and systems

Suggested Textbook/references:


Mode of Delivery
For delivery of Lecture/Lab sessions, I will use Cisco Webex online platform. For Lab Sessions students need to use only MATLAB Software. For discussion about doubts on topics I will use WhatsApp Chat/Call for one-to-one communication, and Online platform such as Google Meet/Zoom for one-to-many communications. For uploading of Lecture slides, assignment problems I will use Google Classroom.

• Only Lecture slides of lecture will be uploaded in Google Classroom.
• Video recording of lecture will not be shared with students in any circumstances.
Evaluation Scheme

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<tr>
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<tr>
<td>Class Quizzes</td>
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<td>Lab Assignments</td>
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<td>Internal Assessment based on overall performance/Activity of student throughout Semester</td>
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Lecture Plan
Following Topics will be covered in Digital Image Processing Course.

Introduction and Digital Image Fundamentals
Digital Image Fundamentals, Human visual system, Image as a 2D data, Image representation – Gray scale and Color images, image sampling and quantization

Image enhancement in Spatial domain:
Basic gray level Transformations, Histogram Processing Techniques, Spatial Filtering, Low pass filtering, High pass filtering

Filtering in the Frequency Domain:
Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering

Image Restoration and Reconstruction:
Noise Models, Noise Reduction, Inverse Filtering, MMSE (Wiener) Filtering

Color Image Processing:
Color Fundamentals, Color Models, Pseudo color image processing

Image Compression:
Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard

Morphological Image Processing:
Erosion, dilation, opening, closing, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons

Image Segmentation:
point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection, Hough transform

Object Recognition and Case studies
Object Recognition- patterns and pattern classes, recognition based on decision – theoretic methods, structural methods, case studies – image analysis.