**20EC41E9 - DIGITAL IMAGE PROCESSING**

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| **Course Category:** | Program Core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 2-2-0 |
| **Prerequisite:** | Engineering Mathematics, Signals and Systems, Digital Signal Processing | **Sessional Evaluation:**  **External Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course**  **Objectives** | Students undergoing this course are expected: | |
| 1. To learn the fundamentals of digital image processing and the relationship between pixels. 2. To understand transformations used in digital image processing algorithms. 3. To understand the spatial and frequency domain image processing 4. To learn the restoration techniques used in image enhancement. 5. To learn how to code and compress the images. 6. To understand fundamentals of color image processing. | |
| **Course Outcomes** | After completing the course, the student will be able to: | |
| CO1 | Describe how digital images are represented and how they are sampled and quantized and define the image processing system and basic relations among pixels. |
| CO2 | Analyse the need for image transforms, types and their properties. |
| CO3 | Study different techniques employed for the enhancement of images in both spatial and frequency domain. |
| CO4 | Explore causes for image degradation and various restoration techniques. |
| CO5 | Understand the techniques for image segmentation and define different image coding techniques and compression models. |
| CO6 | Describe the techniques of colour image processing. |
| **Course**  **Content**  **Course**  **Content** | **UNIT-I**  **DIGITAL IMAGE FUNDAMENTALS:** Digital Image Representation – Digital Image Processing System – Visual Perception – Sampling and quantization – Basic Relationship between pixels – Imaging geometry.  **UNIT – II**  **IMAGE TRANSFORMS:** DiscreteFourier Transform – Properties of 2-D Fourier transform – 2-D Fast Fourier Transform – Walsh Transform – Hadamard Transform – D.C.T. – Haar Transform – Slant Transform – Hotelling Transform.  **UNIT – III**  **IMAGE ENHANCEMENT:** Back ground enhancement by point processing – Histogram Processing – Spatial Filtering – Enhancement in frequency Domain – Image Smoothing – Image Sharpening.  **UNIT – IV**  **IMAGE RESTORATION:** Degradation model – Algebraic approach to restoration – Inverse filtering – Least Mean Square filters – Constrained Least Mean Square restoration – Inverse Restoration.  **IMAGE SEGMENTATION:** Detection of Discontinuities – Edge Linking – Boundary detection and Boundary Description – Thresholding – Region Oriented Segmentation.  **UNIT – V**  **IMAGE CODING & COMPRESSION:** FidelityCriteria – Encoding Process – Transform Encoding – Redundancies and their removal methods – Image compression models and methods – Source coder and decoder – Error free compression – Lossy compression.  **UNIT-VI**  **COLOUR IMAGE PROCESSING:** Colour Image Processing – Colour Model, Pseudo colour image processing – Full colour image processing, Colour Image Filtering, Colour Image Segmentation | |
| **Text Books and Reference Books** | **TEXT BOOKS:**   1. “Digital Image Processing” – Rafael C. Gonzalez, Richard E. Woods, 3rd Ed, Pearson. 2. “Fundamentals of Image Processing” – A. K. Jain, Prentice Hall India.   **REFERENCE BOOKS:**   1. “Digital Image Processing” – William K. Pratt, John Wiley Publications 2. “Digital Image Processing” – K. R. Castleman, Pearson Publications 3. “Fundamentals of Electronic Image Processing” – Weeks Jr, SRIC/IEEE series, PHI. | |
| **E-Resources** | 1. nptel.ac.in/courses/117105079/ 2. [www.ee.columbia.edu/~xlx/courses/ee4830-sp08/notes/lect1-parta.pdf](http://www.ee.columbia.edu/~xlx/courses/ee4830-sp08/notes/lect1-parta.pdf) | |

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| **Contribution of Course Outcomes towards achievement of Program Outcomes** | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | - | - | - | - | - | 1 | 2 | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 1 | 1 | 2 | - | - | - | 1 | 2 | - | 3 | 3 |
| CO4 | 3 | 3 | 3 | 1 | 2 | 1 | - | - | - | 1 | 1 | - | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 2 | 2 | 2 | 3 | 3 |
| CO6 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 | 2 | 2 | 3 | 3 |