# 19CS41E3 - IMAGE PROCESSING AND VISUALIZATION

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-0-0 |
| **Prerequisite:** | Knowledge in Computer Systems, Matrix Algebra, Calculus in Three Dimensions and coordinate transformations. | **Sessional Evaluation:**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |
| **Objectives** | * To get familiar with digital image fundamentals * To get exposed with simple image enhancement, compression, segmentation and restoration techniques in spatial and frequency domain | | |

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| **Course Outcomes** | Upon successful completion of the course, the students will be able to: | |
| CO1 | Learn the fundamental elements of image processing and its applications. |
| CO2 | Understand the basic image transformations and image enhancement. |
| CO3 | Demonstrate concepts of various filtering techniques for image representation. |
| CO4 | Represent various colour models used in wavelet coding techniques. |
| CO5 | Analyze the concept of mathematical techniques for image compression and segmentation. |
| CO6 | Describe fundamental mathematical concepts used for representing and visualizing 3D objects. |
| **Course Content** | UNIT - I Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels. UNIT - II Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial FilteringFrequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters. UNIT - III Noise models– Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering-Minimum Mean Square Error Filtering-Constrained Squares Least Filtering-Geometric Mean Filter. UNIT –IV Color Models: The RGB Color Model- The CMK and CMYK Color Model.Wavelets – SubBand Coding – The Haar Transform- Multiresolution Expansions – Wavelet Transforms in One Dimension. UNIT –V Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding–Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation; Morphological watersheds. UNIT - VI Boundary Representation – Chain Code – Polygonal approximation, signature, boundary segments–Boundary Descriptors – Shape number – Fourier Descriptor, moments- Regional Descriptors–Topological feature, Texture – Moments of Two Dimensional Functions-Relational Descriptors. | |
| **Text Books and References:** | **Text Books:**   1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Second Edition, Pearson Education.   **Reference Books:**   1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata McGraw Hill Pvt. Ltd., 2011. 2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011. 3. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002. 4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011. | |
| **E-Resources** | 1. [https://nptel.ac.in/courses](about:blank) 2. [https://freevideolectures.com/university/iitm](about:blank) | |