CS413: Computer Vision	L	T	P
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Course Objective: To introduce fundamentals of computer vision so that students will understand to program a computer for understanding a scene or features in an image development.

S. No.	Course Outcomes (CO)
CO1	Describe the role of AI and image processing in computer vision and its applications.
CO2	Explain image formation, transformations, and sensor fundamentals, and perform calibration.
CO3	Extract features using various detectors and descriptors, and apply scale-space techniques.
CO4	Apply image representation and segmentation techniques for object detection.
CO5	Analyze patterns and motion with clustering, classification, and tracking algorithms.

S. No	Contents	Contact Hours
UNIT 1	Introduction to Computer Vision: Role of Artificial Intelligence and Image processing in Computer Vision, Industrial Machine Vision Applications, System Architecture, Stages of Computer Vision, State of the art.	8
UNIT 2	Visual Sensors: Camera sensors, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc.; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing, 2D/3D Geometric transformations, Homography, Feature descriptors- SIFT, Ransac, Camera Calibration: Interior and Exterior Calibration.	8

UNIT 3	Feature Extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.	**8**
UNIT 4	Image Representation: Adaptive basis- Principal Component Analysis (PCA) and Independent Component Analysis (ICA), Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFS, Texture Segmentation; Object detection.	**8**
UNIT 5	Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non- parametric methods.	**8**
UNIT 6	Motion and Tracking: Detection and tracking of point features, Optical flow, Tracking-Lucas Kanade & Tomasi method (LK Tracker), Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.	**8**
	Total	**48**