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 ***CSX447 Computer Vision***

**L-T-P-Cr: 3-0-0-3**

**Pre-requisites:** Machine Learning

**Objectives/Overview:**

* To introduce various topics of computer vision with their applications.

**Course Outcomes:**

At the end of the course, a student should know:

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| **Sl. No.** | **Outcome** | **Mapping to POs** |
|  | Basic concepts of computer vision | PO1, PO2  |
|  | Image formation and camera calibration | PO1, PO3 |
|  | Concepts of feature detection and matching | PO1, PO2, PO3 |
|  | Concepts of stereo vision and stereo camera geometry | PO1, PO2, PO3, PO4 |
|  | Concepts of generating shapes from shading.  | PO1, PO2, PO3, PO4, PO5 |
|  | Concepts of structures from motions.  | PO1, PO2, PO3, PO4, PO5 |

**UNIT I: Lectures: 8**

**Image formation and camera calibration**: Introduction to computer vision, geometric camera models, orthographic and perspective projections, weak perspective projection, intrinsic and extrinsic camera parameters, linear and nonlinear approaches of camera calibration.

**UNIT II: Lectures: 6**

**Feature detection and matching:** Edge detection, interest points and corners, local image features, feature matching and Hough transform, model fitting and RANSAC, scale invariant feature matching.

**UNIT III: Lectures: 12**

**Stereo Vision:** Stereo camera geometry and epipolar constraints, essential and fundamental matrix, image rectification, local methods for stereo matching: correlation and multi-scale approaches, global methods for stereo matching: order constraints and dynamic programming, smoothness and graph-based energy minimization, optical flow.

**UNIT IV: Lectures: 10**

**Shape from Shading:** Modeling pixel brightness, reflection at surfaces, the Lambertian and specular model, area sources, photometric stereo: shape from multiple shaded images, modeling inter-reflection, shape from one shaded image.

**UNIT V: Lectures: 6**

**Structure from motion:** Camera self-calibration, Euclidean structure and motion from two images, Euclidean structure and motion from multiple images, structure and motion from weak-perspective and multiple cameras.

**Text/ Reference Book:**

1. Forsyth, D. A. and Ponce, J., "Computer Vision: A Modern Approach", Prentice Hall, 2nd Ed.
2. Szeliki, R., "Computer Vision: Algorithms and Applications", Springer.
3. Hartley, R. and Zisserman, A., "Multiple View Geometry in Computer Vision", Cambridge University Press.