राष्ट्रीय प्रौद्योगिकी संस्थान पटना / NATIONAL INSTITUE OF TECHNOLOGY PATNA
संगणक विज्ञान एंव अभियांत्रिकी विभाग / DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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No:- **Date:**

CSX4209 Computer Vision

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

Pre-requisites: NIL

Objectives/Overview:

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

Course Outcomes:

At the end of the course, a student should:

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

UNIT I: Image formation and camera calibration **Lectures: 8**

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: Feature detection and matching **Lectures: 6**

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

UNIT III: Stereo Vision **Lectures: 12**

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: Shape from Shading **Lectures: 10**

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: Structure from motion **Lectures: 6**

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 Books

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..