NIRMA UNIVERSITY
School of Technology, Institute of Technology
B.Tech. Electronics & Communication Engineering
Semester - VII
Department Elective V

L	T	P	C
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Course Code	2ECDE62
Course Title	Computer Vision

Course Outcomes (COs):

At the end of the course, students will be able to –

1. apply mathematical modeling methods for low, intermediate, and high-level Image processing tasks.
2. comprehend the geometric relationships between 2D Images and the 3D world.
3. utilize motion and shape analysis algorithms for computer vision applications.
4. perform experiments on computer vision problems.

Syllabus **Teaching Hours: 45**

UNIT I: Depth Estimation and Multi-camera Views **08**

Projective geometry, transformation and estimation, properties of homography and its application in robotics, camera geometry, single view and multiview geometry, epipolar geometry; Rectification, RANSAC

UNIT II: Basics of Image Processing and Feature Extraction **10**

Fundamentals of Image formation, Image transformation and Image filtering, edge detection algorithms - canny, log, sobel; line detectors,, corners detectors – Harris and hessian affine, orientation histogram, SIFT, HOG, scale-space analysis, Image pyramids, and Gaussian derivative filters, Gabor filters, and DWT.

UNIT III: Image Segmentation **08**

Region growing, Active contours, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation.

UNIT IV: Motion Analysis **07**

Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

UNIT V: Shape from X **07**

Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation, Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion, and edges.

UNIT-VI: Applications of Computer Vision **05**

Image-based rendering, Image Stitching, Recognition, Robotic applications, Deep Learning based Computer Vision Applications.

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Readings:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer
2. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson Education
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press

4. K. Fukunaga, Introduction to Statistical Pattern Recognition, Academic Press, Morgan Kaufmann
5. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison-Wesley

L = Lecture, T = Tutorial, P = Practical, C = Credit