COMPUTER VISION

Course Code	23CS4702C	Year	IV	Semester	I
Course Category	PE	Branch	CSE	Course Type	Theory
Credits	3	L – T – P	3-0-0	Prerequisites	Calculus &Linear Algebra, Probability Theory
Continuous Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the fundamental principles of image formation, including camera models, radiometry, shading, color perception, and texture representation	L2
CO2	Apply filters and convolution to enhance images, detect edges, and extract features while handling noise and aliasing	L3
CO3	Apply geometric camera models and multiple-view geometry for 3D reconstruction	L3
CO4	Apply model-based vision, segmentation, and tracking for practical applications	L3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	√											√	
CO2	√												
CO3		√											
CO4			√			√							

Syllabus

Unit No.	CONTENTS	Mapped CO
I	**CAMERAS: Pinhole Cameras Radiometry** – Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color	CO1
II	**Linear Filters:** Linear Filters and Convolution, Shift Invariant Linear Systems, Sampling and Aliasing, Filters as Templates, **Edge Detection**: Noise, Estimating Derivatives, Detecting Edges **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids	CO1, CO2
III	**The Geometry of Multiple Views:** Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras **Segmentation**: Segmentation by Clustering: Segmentation, Human Vision: Grouping and Getstalt, **Applications:** Shot Boundary Detection and Background Subtraction. 3D shape construction	CO3, CO4
IV	**Segmentation by Fitting a Model**: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Linear Dynamic Models, Kalman Filtering, Data Association. Region-based & graph-based segmentation	CO4

V	**Geometric Camera Models**: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation. **Case study I**: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, **Case study II**: Registration In Medical Imaging Systems.	**CO3, CO4**

Learning Resources
Text Books
1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.
Reference Books
1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013. 2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008. 3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.
E-Resources & other digital material
1. https://sites.usc.edu/iris-cvlab/ 2. https://onlinecourses.nptel.ac.in/noc21_ee23/preview 3. https://nptel.ac.in/courses/106105216 4. https://www.coursera.org/learn/introduction-computer-vision-watson-opencv 5. https://www.coursera.org/projects/computer-vision-opencv-for-images