PVP SIDDHARTHA INSTITUTE OF TECHNOLOGY **PVP 23**
(Autonomous)
COMPUTER VISION (Honors)

Course Code	23IT6601	**Year**	III	**Semester**	II
Course Category	Honors	**Branch**	IT	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Artificial Intelligence
Continuous Internal Evaluation	30	**Semester End Evaluation:**	70	**Total M arks:**	100

Couse Outcomes:

Upon successful completion of the course, the student will be able to		
CO1	Understand radiometry, image formation, shading, and color models in digital imaging.	L2
CO2	Apply linear filtering, Fourier transforms, edge detection, and texture analysis for image processing tasks.	L3
CO3	Analyze images using multi-view geometry, stereopsis, and segmentation by clustering.	L4
CO4	Apply model fitting techniques, probabilistic segmentation, EM algorithm, and Kalman filtering for tracking.	L3
CO5	Understand geometric camera models, perform camera calibration, and apply vision techniques for localization and medical imaging registration.	L3

Correlation between CO – PO, CO- PSO (Use √ symbol for representing correlation)

PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	✓	✓	✓	✓	✓	–	–	–	–	–	–	✓	✓
CO2	✓	✓	✓	✓	✓	–	–	–	–	–	–	✓	✓
CO3	✓	✓	✓	✓	✓	–	–	–	–	–	–	✓	✓
CO4	✓	✓	✓	✓	✓	–	–	–	–	–	–	✓	✓
CO5	✓	✓	✓	✓	✓	–	–	–	–	–	–	✓	✓

CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	2	1	1	2	–	–	–	–	–	–	1	1
CO2	1	3	2	2	3	–	–	–	–	–	–	1	3
CO3	1	3	2	2	3	–	–	–	–	–	–	1	3
CO4	1	3	3	3	3	–	–	–	–	–	–	1	3
CO5	1	2	3	3	3	–	–	–	–	–	–	1	3

UNIT –I: **CO1**

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, Application: Photometric Stereo, Interreflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT-II: **CO2**

Linear Filters:Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection:Noise, Estimating Derivatives, Detecting Edges Texture0:Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT-III: C**O3**

The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT-IV: **CO 4**

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT-V: **CO5**

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, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,

Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration In Medical Imaging Systems, CurvedSurfaces and Alignment.

Text Books:

1. David A. Forsythand 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.