COURSE CONTENT

COMPUTER VISION								
II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSE17	**Elective**	3	-	-	3	40	60	100
Contact Classes:45	**Total Tutorials:Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Computer Organization and Architecture								

I. COURSE OVERVIEW:

This course introduces the principles, algorithms, and applications of computer vision. Students will learn how to extract meaningful information from images and videos, understand various computer vision tasks, and apply techniques to solve real-world problems.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Both the theoretical and practical aspects of computing with images.
II. The foundation of image formation, measurement, and analysis.
III. The geometric relationships between 2D images and the 3D world.
IV. The principles of state-of-the-art deep neural networks.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1 Analyze image filtering operations to enhance image quality
CO 2 Explore the methods of recognition of objects and scenes and categorization from images
CO 3 Apply threshold techniques, morphological processes, and region-growing methods for edge detection in images
CO 4 Develop clustering-based segmentation solutions for image synthesis
CO 5 Synthesize and evaluate classification procedures for texture and feature analysis.
CO6 Select and apply appropriate techniques for object recognition and detection in computer vision-based applications.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION AND IMAGE ENHANCEMENT (10)

The nature of the vision, Low-level vision – Gray scale versus color, Image processing operations; Basic image filtering operations – Gaussian smoothing, Median filters, Mode Filters, Rank Order Filters, Sharp and Unsharp masking.

MODULE-II: THRESHOLDING AND EDGE DETECTION (09)

Region-growing methods, Thresholding, Adaptive thresholding, Threshold selection – Variance-based thresholding, Entropy-based thresholding, Maximum likelihood thresholding; Global valley approach to thresholding; Edge Detection – Template Matching Approach, 3×3 Template Operators, Canny Operator, Laplacian Operator; Dilation and erosion in binary images – Properties of dilation and erosion operators, Closing and opening. Edge detection performance, Hough transform, corner detection.

MODULE-III: SEGMENTATION BY CLUSTERING (10)

Grouping and gestalt, Important applications – Background subtraction, Shot boundary detection, Interactive segmentation, Forming imaging regions; Image segmentation by clustering pixels, Segmentation, clustering and graphs – Terminology and facts for graphs, Agglomerative clustering with a graph, Divisive clustering with a graph, Normalized cuts.

MODULE-IV: FEATURE EXTRACTION (09)

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, and data pre-processing.

MODULE-V: PATTERN ANALYSIS (10)

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised

Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.

V. TEXTBOOKS:

1. David A. Forsyth, Jean Ponce, Computer Vision: A Modern Approach, Pearson, 2nd edition, 2012.
2. E. R. Davies, Computer and Machine Vision: Theory, Algorithms, Practicalities, Elsevier, 5th edition, 2017.

VI. REFERENCE BOOKS:

1. Richard Szeliski. "Computer Vision: Algorithms and Applications" 5nd edition, 2012.
2. Fisher, "Dictionary of Computer Vision and Image Processing, 4nd edition, 2015.

VII. WEB REFERENCES:

1. https://slideplayer.com/slide/5158896/
2. www.scs.carleton.ca/~c_shu/Courses/comp4900d/notes/PPT/lect1_intro.ppt

VIII. E-Text Books:

1. https://www.intechopen.com/books/3765
2. https://vdoc.pub/download/computer-vision-a-modern-approach-712q6l0ut2s0
3. https://www.e-booksdirectory.com/details.php?ebook=10885

IX. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open,Ended experiments

5. Definitions and terminology
6. Assignments
7. Model question paper, I
8. Model question paper, II
9. Lecture notes
10. Power Point presentation
11. E-Learning Readiness Videos (ELRV)