Course Title	Digital Image Processing and Computer Vision				Course Type		Theory-SC	
Course Code	B20EFS614	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-							
	Total	**3**	**3**	**3**	**39**	**0**	**50**	**50**

COURSE OVERVIEW:

Computer Vision is one of the fastest growing and most exciting AI disciplines in today's academia and industry. This course is designed to open the doors for students who are interested in learning about the fundamental principles and important applications of computer vision. The course, introduces a number of fundamental concepts in computer vision, expose students to a number of real-world applications that are important to our daily lives. More importantly, students will be guided through a series of well-designed projects such that they will get to implement using few interesting and cutting-edge computer vision algorithms. The course benefit is to apply computer vision algorithms to solve real world problems.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamentals of Computer vision
2. Describe various image preprocessing techniques.
3. Demonstrate the use of techniques image transformation and color image processing.
4. Gain expertise in object detection and recognition applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
1	Utilize linear filters to enhance the quality of images in given real world application.	1 to 5	1
2	Apply segmentation techniques to solve real world problems.	1 to 5	2

3	Develop image transformation techniques for solving real world problems.	1 to 5	3
4	Make use of object detection and recognition techniques to computer vision applications	1 to 5	3
5	Illustrate different filtering technique for Image Restoration and Reconstruction.	1 to 5	1
6	Apply watermarking and image compression techniques in computer vision applications.	1 to 5	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5		√				
CO6		√				

COURSE ARTICULATION MATRIX

CO#/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2								3		
CO2	3	3	2	1	3									3	
CO3	3	3	3	2	2										3
CO4	3	3	3	1	1										3
CO5	3	2	3	2	3								3		
CO6	3	2	2	3	3										3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT-1

Introduction: What is Digital Image Processing?, The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

Digital Image Fundamentals: Image Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships between Pixels, Introduction to the Basic Mathematical Tools Used in Digital Image Processing

UNIT-2

Intensity Transformations and Spatial Filtering: Background, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters

Filtering in the Frequency Domain: Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters,

UNIT-3

Image Restoration and Reconstruction: Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering,

UNIT-4

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, **Wavelets and Multiresolution Processing: Wavelet and Other Image Transforms:** Preliminaries, Haar Transform, Multiresolution

Morphological Image Processing:

Basic Concepts, Dilation and Erosion, Opening and Closing, Hit or miss transformation, sample applications

TEXT BOOKS:

1. Rafael C. Gonzalez, University of Tennessee, Richard E. Woods, Med Data Interactive, **"**Digital Image Processing**"**, 4th Edition, Pearson**,** 2018

REFERENCE BOOKS:

1. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach" , 2nd Edition, University of Illinois at Urbana-Champaign Jean Ponce, Ecole NormaleSuperieure, Paris©2012, Pearson
2. Richard Szeliski, " Computer Vision: Algorithms and Applications" , Springer
3. David Marr, Tomaso A. Poggio, Shimon Ullman "A Computational Investigation into the Human Representation and Processing of Visual Information", , eBook - Amazon.com

JOURNALS/MAGAZINES:

1. International Journal of Computer Vision, Springer
2. Image and Vision Computing, Elsevier
3. Computer Vision and Image Understanding, Elsevier
4. IEEE Transactions on Image Processing
5. IEEE Transactions on Pattern recognition and machine intelligence

SWAYAM/NPTEL/MOOCs:

1. Computer Vision and Image Processing - Fundamentals and Applications: https://onlinecourses.nptel.ac.in/noc21_ee23/preview
2. Computer Vision: https://nptel.ac.in/courses/106/105/106105216/
3. Deep Learning for Computer Vision: https://nptel.ac.in/courses/106/106/106106224/

SELF-LEARNING EXERCISES:

1. Artificial Neural Networks, Convolutional Neural Networks.
2. Implementation of applications using the above topics