Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECC603	Digital Image Processing and Machine Vision	03	--	--	03	--	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Exam Duration (Hrs.)	Term Work	Practical and Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test2	Avg.					
ECC603	Digital Image Processing and Machine Vision	20	20	20	80	03	--	--	100

Prerequisites:
1. Signals and Systems
2. Discrete Time Signal Processing
3. Python Programming Skill Lab

Course Objectives:
1. To teach the fundamentals and mathematical models in digital image processing and Machine Vision
2. To teach quality enhancement of image through filtering operations
3. To teach the students image morphology and restoration techniques
4. To expose the students to segmentation techniques in image processing and Machine Vision
5. To teach the techniques of extracting image attributes like regions and shapes
6. To learn classification and recognition algorithms for machine vision

Course Outcomes:
After successful completion of the course student will be able to
1. Understand fundamentals of image processing and machine vision
2. Enhance the quality of image using spatial and frequency domain techniques for image enhancement
3. Learn image morphology and restoration techniques
4. Learn image segmentation techniques based on principle of discontinuity and similarity using various algorithms
5. Represent boundaries and shapes using standard techniques.
6. Classify the object using different classification methods

Module No.	Unit No.	Topics	Hrs.
1		**DIGITAL IMAGE FUNDAMENTALS AND POINT PROCESSING**	**04**
	1.1	Introduction –Steps in Digital Image Processing, concept of spatial and intensity resolution, Relationships between pixels	02
	1.2	**Point Processing :** Image Negative, Log Transform, Power Law transform, Bit plane slicing, Contrast stretching , Histogram equalization and Histogram Specification	02
2		**IMAGE ENHANCEMENT**	**08**
	2.1	**Spatial Domain filtering :** The Mechanics of Spatial Filtering, **Smoothing Spatial Filters**-Linear Filters-Averaging filter, Order-Statistic Filters- Median filter, Application of Median filtering for Noise removal **Sharpening Spatial Filters**- The Laplacian, Unsharp Masking and Highboost Filtering, Using First-Order Derivatives —The Gradient- Sobel, Prewitt and Roberts	03
	2.2	**Frequency Domain Filtering:** Introduction to 2-D DFT and its application in frequency domain filtering, Wavelet transform, Haar transform	02
	2.3	**Frequency Domain Filtering Fundamentals,** Fourier Spectrum and Phase angle ,Steps for Filtering in the Frequency Domain, Correspondence Between Filtering in the Spatial and Frequency Domains, Frequency domain Image Smoothing and sharpening filter - Ideal, Butterworth , Gaussian	03
3		**IMAGE MORPHOLOGY AND RESTORATION**	**06**
	3.1	**Morphology:** Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Boundary extraction , Hole filling, Thinning and thickening	04
	3.2	**Restoration :** A Model of the Image Degradation/Restoration Process, Noise models, Removal periodic noise, Principle of Inverse filtering	02
4		**IMAGE SEGMENTATION**	**08**
	4.1	**Point, Line, and Edge Detection:** Detection of Isolated Points, Line detection, edge models, Canny's edge detection algorithm , Edge linking : Local processing and boundary detection using regional processing (polygonal fitting)	05
	4.2	**Thresholding :** Foundation, Role of illumination and reflectance, Basic global thresholding	01
	4.3	**Region Based segmentation:** Region Growing, Region Splitting and merging	02
5		**INTRODUCTION TO MACHINE VISION AND DESCRIPTORS**	**05**
	5.1	Principle of machine vision , real world applications, chain code, simple geometric border representation, Fourier Transform of boundaries, Boundary description using segment sequences	03
	5.2	Introduction to Texture, co-occurrence matrix	02
6		**MACHINE VISION ALGORITHMS**	**08**
	6.1	Knowledge representation, Classification Principles, Classifier setting, Classifier Learning, Confusion Matrix	02
	6.2	K-means clustering algorithm, Introduction, bays decision theory continuous case, two category classification, Bayesian classifier ,Support vector machine	06
		TOTAL	**39**

Text Books:

1. Milan Sonka ,Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision" Cengage Engineering, 3rd Edition, 2013
2. Gonzales and Woods, "Digital Image Processing", Pearson Education, India, Third Edition,
3. R. O. Duda and P. E. hart, Pattern classification and scene analysis, Wiley Interscience publication
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

Reference books:

1. Anil K.Jain, "Fundamentals of Image Processing", Prentice Hall of India, First Edition, 1989.
2. W Pratt, "Digital Image Processing", Wiley Publication, 3rd Edition, 2002
3. Forsyth and Ponce, Computer vision: A modern approach, PHI
4. Frank Y Shish ,Image Processing and Pattern Recognition: Fundamentals and Techniques, Wiley Wiley-IEEE Press, 2010

Internal Assessment (20-Marks):

Internal Assessment (IA) consists of two class tests of 20 marks each. IA-1 is to be conducted on approximately 40% of the syllabus and IA-2 will be based on remaining contents (approximately 40% syllabus but excluding contents covered in IA-I). Duration of each test shall be one hour. Average of the two tests will be considered as IA marks.

End Semester Examination (80-Marks):

Weightage to each of the modules in end-semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of **total 06** questions, each carrying **20 marks**.
2. **Question No: 01** will be **compulsory** and based on entire syllabus wherein 4 to 5 sub-questions will be asked.
3. Remaining questions will be mixed in nature and randomly selected from all the modules.
4. **Total 04 questions** need to be attempted.