SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

IMAGE PROCESSING AND COMPUTER VISION

(Effective from the Academic Year 2024 - 2025)

VI SEMESTER

Course Code:	**AM622T3A**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of Image concepts and applications, linear Algebra.

COURSE OBJECTIVES:

- Describe the fundamentals of image processing and computer vision
- Illustrate the image enhancement techniques
- Illustrate Image restoration and image compression technique
- Describe the image segmentation and morphological image processing
- Review computer vision techniques and its applications.

TEACHING - LEARNING STRATEGY:

- Following are some sample strategies that can be incorporate for the Course Delivery
- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODUDLE - I

Computer vision and Image formation: Overview of computer vision and its application in real world **Image formation:** Geometric primitives and transformations like 2D, 3D and 3D rotations, 3D to 2D projections, lens distortion Photometric image formation with lighting, Reflectance and shading, optics The digital camera- Sampling and aliasing and compression	**8 Hours**

MODULE – II

Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.	

MODULE – III

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, -Smoothing Spatial Filters, Sharpening Spatial Filters **Frequency Domain:** Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, and Selective Filtering.	**8 Hours**

MODULE – IV

Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, and Constrained Least Squares Filtering.	**8 Hours**

MODULE – V

Wavelets: Background, Multiresolution Expansions. **Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, and Some Basic Morphological Algorithms.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand, Ascertain and describe the basics of image processing concepts through mathematical interpretation	CL3
CO2	Apply image processing techniques in both the spatial and frequency (Fourier) domains.	CL3
CO3	Demonstrate image restoration process and its respective filters required.	CL3
CO4	Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies	CL3
CO5	Conduct independent study and analysis of Image Enhancement techniques.	CL2

LABORATORY COMPONENTS

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3						1			1		
CO2	3	3	3	2	2				1			1		
CO3	3	3	3	2	2				1			1		
CO4	3	3	3	2	2				1			1		
CO5	3	3	3						2			1		
3: Substantial (High)					2: Moderate (Medium)					1: Poor (Low)				

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
30%	40%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Computer Vision: Algorithms and Applications 2nd Edition Richard Szelisk (Chapter 1 & 2)
2. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008. (Chapter 1,2,3,4,5,7,
3. Digital Image Processing- S. Jayaraman, S. Esakkirajan, T. Veerakumar, TataMcGraw Hill 2014.
4. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.
5. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd Edition, 2016.
6. Computer Vision, A Modern Approach David A Forsyth, Jean Ponce