

FACULTY OF COMPUTER APPLICATIONS
B.Sc (Information Technology)

- **Sem.** : 6
- **Subject Code** : 05BS0606
- **Subject** : Image Processing and Machine Vision
- **Course Objectives** :
 1. To understand fundamental concepts of digital image processing.
 2. To understand the spatial filtering and pre processing methods.
 3. To understand the concept of color images.
 4. To understand the basic principles and components of Machine Vision system.
 5. To understand the various applications of Machine Vision.
- **Prerequisites:** Basic knowledge of Mathematics, Computer Graphics and python programming

Unit No	Topics Covered	No of lectures required
1	Digital Image Fundamentals Concept of Pixel and its value, Image size and Resolution, Various Image File formats : Raster Vs Vector Data, Concept of GIF,PNG,JPEG,BMP image Formats, Fundamental Steps of Digital Image Fundamentals, Image Sensing and Acquisition, Sampling and Quantization, Spatial and Intensity Resolution, Basic Relationships between Pixels	09
2	Intensity Transformation and Filtering Basics of Intensity Transformation and Spatial Filtering, Image Negatives, Log Transformation, Histogram Processing and Equalization, Convolution, Image Degradation / Restoration Process& Noise Models, Local pre-processing: Image smoothing, Edge detectors, Scale in image processing, Canny edge detection	09

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3	Introduction to Color Image Processing Color Fundamentals and Color Models :The RGB Color Model, The CMY and CMYK color Models, The HSI Color Model, Concept of color image :Organization of Color Images ,Color Spaces and Color Conversion, Pseudo color Image Processing :Intensity Slicing, Intensity to color Transformations	09
4	Introduction to Machine Vision and Hardware Components Evolution of Computer Vision, Computer/Machine Vision and Image Processing, Machine Vision System, Machine Vision Camera: CCD and CMOS Image Sensors, TDI Sensor, Camera Type - Area Scan Cameras, Line Scan Cameras, Smart Cameras	09
5	Digital Image processing for Machine Vision Applications Face recognition, Object detection, Plant leaf disease detection, Automotive Industries and Manufacturing	09

Course Outcomes:

1. Students will be able to interpret & understand image in its numeric and graphical form.
2. Students will be able to apply pre processing and filtering methods on given image.
3. Students will be understand and representation of color image processing with various models.
4. Students will be able to understand the need of Machine Vision and their components.
5. Students will be able to apply concepts of digital image processing in Machine Vision applications.

Course Outcomes – Program Outcomes Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	L				H	H
CO2	M	H	L	L	L	L	H	H
CO3								M
CO4	M						M	
CO5	H	H	H		L		M	H

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Text Book :

1. **Sheila Anand and L. Priya , –A Guide for Machine Vision in Quality Controll, Taylor & Francis Inc, Imprint CRC Press Inc, Dec 2019**
2. **Principles of Digital Image Processing, Wilhelm Burger, Mark J. Burge, Springer Science + Business Media**
3. **Rafael C. Gonzalez and Richard E. Woods, – “Digital Image Processing”, Pearson**

Reference Books :

1. Image processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac, Roger Bolye, Cengage Learning, Fourth Edition
2. Machine Vision, Ramesh Jain, Rangachar Kasturi, Brian G. Schunck , McGraw Hill, 1995
3. Herbert Freeman, Machine Vision: Algorithms, Architectures and Systems (2012), Academic Press.

Web References:

1. <https://nptel.ac.in/courses/106/105/106105032/>
2. https://www.python-course.eu/python_image_processing.php
3. <https://www.coursera.org/programs/milap-faculty-program-mm3kt/browse?query=computer+vision+&source=search>
4. <https://www.coursera.org/videos/introduction-computer-vision-watson-opencv/YmBDp?query=computer+vision+&source=search>

App References:

1. Digital Image Processing, Engineering App
2. Image Processing Tutorials, Galaxy Production



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Syllabus Coverage from text /reference book & web/app reference:

Unit #	Chapter Numbers
1	Text Book 2 - chapter - 1,2,8
2	Text Book 3 - chapter - 3,4,5
3	Text Book 3 - chapter - 6
4	Text Book 1 - chapter - 1, chapter - 3
5	Text Book 1 - chapter - 7

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PRACTICALS

Perform all the practical's using Python programming language.

Unit No	List of Practical's
1	1. Introduction to OpenCV, Scikit-image, SciPy libraries of Python with Basic commands 2. Read at least five images and displays on screen 3. Change size of the image 4. Convert color image into gray-scale image 5. Convert color image into black & white 6. Create color image using R, G and B three separate planes 7. Crop image 8. Rotate Image 9. Convert Flip image 10. Apply Thresholding on image
2	1. Addition & Subtraction of two images 2. Calculate mean value of image 3. Apply Brightness to image by changing mean value 4. NOT operation (Negative image) 5. Apply spatial filtering on Image 6. Create histogram of image 7. Write a programs to remove noise using spatial filters 8. Apply Median filter on Image 9. Perform Image degradation operation 10. Apply Minimize Gaussian noise
3	To write a program which apply the following geometric transformation on color image 1. Translation 2. Scaling 3. Rotation 4. Shrinking 5. Zooming
4	1. Write a python Program for canny edge detection 2. Write a python Program for sobel edge detection 3. To Implement smoothing or averaging filter in spatial domain 4. To fill the region of interest for the image
5	1. Detecting product defects 2. Potato Disease Classification 3. Face Detection 4. Any object detection