Dr. Ambedkar Institute of Technology,Bengaluru-56

Department of Computer Science & Engineering

Scheme and Syllabus-NEP – 2023 -2024

CourseTitle	**COMPUTER GRAPHICS AND FUNDAMENTALS OF IMAGE PROCESSING**						
CourseCode	**21CST602**						
Category	Integrated Professional Core Course (IPCC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	02	00	05	52	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE:03 Hours**		

Course Objectives:

1. Overview of Computer Graphics along with its applications.
2. Exploring 2D and 3D graphics mathematics along with OpenGL API's.
3. Use of Computer graphics principles for animation and design of GUI's.
4. Introduction to Image processing and Open CV.
5. Image segmentation using Open CV.

Unit-1 (09 Hrs.)
Overview: Computer Graphics hardware and software and OpenGL: Computer Graphics: Video Display Devices, Raster-Scan Systems Basics of computer graphics, Application of Computer Graphics. **OpenGL:** Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's).
Unit-2 (08 Hrs.)
2D and 3D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, **3D Geometric Transformations:** Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions
Unit-3 (09 Hrs.)
Interactive Input Methods and Graphical User Interfaces: Graphical Input Data, Logical Classification of Input Devices, Input Functions for Graphical Data , Interactive Picture-Construction Techniques, Virtual-Reality Environments, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions , Designing a Graphical User Interface. **Computer Animation :**Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures.
Unit-4 (08 Hrs.)
Introduction to Image processing: Overview, Nature of IP, IP and its related fields, Digital Image representation, types of images. **Digital Image Processing Operations:** Basic relationships and distance metrics, Classification of Image processing Operations.

Unit-5 (08 Hrs.)
Image Segmentation: Introduction, classification, detection of discontinuities, Edge detection (up to canny edge detection (included)).

Course Outcomes

At the end of the course the student will be able to:

CO 1. Construct geometric objects using Computer Graphics principles and OpenGL APIs.

CO 2. Use OpenGL APIs and related mathematics for 2D and 3D geometric Operations on the objects.

CO 3. Design GUI with necessary techniques required to animate the created objects

CO 4. Apply OpenCV for developing Image processing applications.

CO 5. Apply Image segmentation techniques along with programming, using OpenCV, for developing simple applications.

	Practice Programs
	• Installation of OpenGL /OpenCV/ Python and required headers • Simple programs using OpenGL (Drawing simple geometric object like line, circle, rectangle, square) and using OpenCV (operation on an image/s)
Sl. No.	**PART A** **List of problems for which student should develop program and execute in the Laboratory using openGL/openCV/ Python**
1.	Develop a program to draw a line using Bresenham's line drawing technique
2.	Develop a program to demonstrate basic geometric operations on the 2D object
3.	Develop a program to demonstrate basic geometric operations on the 3D object
4.	Develop a program to demonstrate 2D transformation on basic objects
5.	Develop a program to demonstrate 3D transformation on 3D objects
6.	Develop a program to demonstrate Animation effects on simple objects.
7.	Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left.
8.	Write a program to show rotation, scaling, and translation on an image.
9.	Read an image and extract and display low-level features such as edges, textures using filtering techniques.
10.	Write a program to blur and smoothing an image.
11.	Write a program to contour an image.
12.	Write a program to detect a face/s in an image
	PART B **Practical Based Learning**
	Student should develop a mini project and it should be demonstrate in the laboratory examination, Some of the projects are listed and it is not limited to: ➢ Recognition of License Plate through Image Processing ➢ Recognition of Face Emotion in Real-Time ➢ Detection of Drowsy Driver in Real-Time

	➢ Recognition of Handwriting by Image Processing ➢ Detection of Kidney Stone ➢ Verification of Signature ➢ Compression of Color Image ➢ Classification of Image Category ➢ Detection of Skin Cancer ➢ Marking System of Attendance using Image Processing ➢ Detection of Liver Tumor ➢ IRIS Segmentation ➢ Detection of Skin Disease and / or Plant Disease ➢ Biometric Sensing System. ➢ Projects which helps to formers to understand the present developments in agriculture. ➢ Projects which helps high school/college students to understand the scientific problems. ➢ Simulation projects which helps to understand innovations in science and Technology The tasks when implementing mini project would be: 1. Understand the complete domain knowledge of the application and derive the complete data requirement specification for the mini project. 2. Documentation & submission of report.

Textbooks

1. Donald D Hearn, M Pauline Baker and WarrenCarithers: Computer Graphics with OpenGL 4th Edition, Pearson, 2014
2. S. Sridhar, Digital Image Processing, second edition, Oxford University press 2016.

Reference Books

1. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/106/106106090/
2. https://nptel.ac.in/courses/106/102/106102063/
3. https://nptel.ac.in/courses/106/103/106103224/
4. https://nptel.ac.in/courses/106/102/106102065/
5. https://www.tutorialspoint.com/opencv/ (Tutorial, Types of Images, Drawing Functions)
6. https://medium.com/analytics-vidhya/introduction-to-computer-vision-opencv-in-python-fb722e805e8b

MAPPING of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3							2
CO2	3	3	3	2	3							
CO3	3	3	3	2	3							
CO4	3	3	3	2	3							2
CO5	3	3	3	2	3							2
Strength of correlation: Low-1,Medium-2, High-3												

Faculty Incharge
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