FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Computer Engineering)**

Semester: **V**

Course Code: **202045606**

Course Title: **Computer Graphics**

Course Group: **Professional Elective Course**

Course Objectives: This course equips students with the fundamental knowledge and basic technical competence in the field of Computer Graphics. It includes various display technologies, 2D and 3D object representation, transformation, viewing, clipping, and various color models. The course enables students to implement various algorithms of computer graphics like line, circle and ellipse drawing, color filling, transformation and clipping.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction:** Basics of computer graphics, applications of computer graphics, display devices, raster scan systems, random scan systems, graphics monitors and workstations, input devices, hard copy devices, graphics software	06
2	**Graphics Primitives:** Output primitives: points and lines, line drawing algorithms, circle and ellipse generating algorithms, loading the frame buffer, pixel addressing and object geometry, filled area primitives including scan-line polygon filling, inside-outside test, boundary and flood fill, character generation	08

3	**2D Transformation and Viewing:** Two-dimensional geometric transformations: matrix representations and homogeneous coordinates, composite transformations, Two-dimensional viewing: viewing pipeline, viewing coordinate reference frame, widow-to-viewport coordinate transformation, two-dimensional viewing functions, Clipping operations: point clipping, line clipping (Cohen-Sutherland, Liang Barsky, NLN) and polygon clipping algorithms	**06**
4	**3D Concepts and Object Representation:** 3D display methods, visible surface detection methods: classification of visible surface detection algorithms, back face detection, depth buffer method, A buffer method, Three-dimensional object representations: polygon surfaces, polygon tables, plane equations, polygon meshes, curved lines and surfaces, quadratic surfaces, blobby objects, cubic spline interpolation methods, Spline representations: Bezier curves and surfaces, B-spline curves and surfaces	**06**
5	**3D Transformation and Viewing:** Three-dimensional geometric and modeling transformations: translation, rotation, scaling, composite transformations, Three-dimensional viewing: viewing pipeline, viewing coordinates, Projections: parallel and perspective, view volume and general projection transformations	**08**
6	**Illumination and Color Models:** Light sources: basic illumination methods, ambient, diffuse reflection, specular reflection, displaying light intensities, halftone patterns and dithering techniques, Properties of light: standard primaries and chromaticity diagram, Intuitive color concepts: RGB, YIQ, CMY, HSV,HLS color models, color selection	**06**
	Total	**40**

List of Practicals / Tutorials:

1	Implement basic Graphics functions.
2	Perform animation such as rising Sun, moving vehicle, smileys, screen saver etc.
3	1. Implement Digital Differential Analyzer algorithm. 2. Implement Bresenham's line drawing algorithm.
4	Develop a program to display different types of lines.
5	Implement midpoint circle drawing algorithm.
6	Implement midpoint ellipse drawing algorithm.
7	1. Develop a program to fill color in the given object using flood fill algorithm. 2. Develop a program to fill color in the given object using boundary fill algorithm.
8	Implement 2D transformations i.e. translation, rotation, scaling, reflection and shearing.
9	Implement Cohen-Sutherland line clipping algorithm.
10	Perform the following tasks using MATLAB. 1. Read the grayscale and color image. 2. Display images on the computer monitor 3. Write images in your destination folder. 4. Complement Image.
11	Perform color segmentation using MATLAB.

12	Develop a Mini Project using various Graphics functions.

Reference Books:

1	D. Hearn and P. Baker, "Computer Graphics (C-Version)", Pearson Education
2	Foley and van Dam, "Computer Graphics", Person Education
3	Hearn and Baker, "Computer Graphics with Open GL", Pearson Education
4	Madasu Hanmandlu, "Computer Graphics", BPB Publication
5	David F Rogers, "Procedural Elements for Computer Graphics", Mc-GrawHill
6	David F Rogers, "Mathematical Elements for Computer Graphics", Mc-GrawHill

Supplementary learning Material:	
1	NPTEL - Swayam Courses: https://onlinecourses.nptel.ac.in/noc21_cs97/preview

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
15%	25%	15%	15%	25%	5%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To understand various computer graphics hardware and display technologies.	**10**
CO-2	To be able to implement appropriate algorithms to draw 2D objects.	**20**
CO-3	To be able to apply two-dimensional transformations, viewing and clipping.	**25**
CO-4	To understand 3D object representation and apply three-dimensional transformations and viewing.	**25**
CO-5	To understand the concept of Illumination and color models.	**20**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025