FACULTY OF ENGINEERING & TECHNOLOGY

Third Year Bachelor of Engineering

Course Title: Computer Graphics and Design

Course Code: 202045611

Type of Course: Professional Core Course

Course Objectives:

This course provides students the fundamental knowledge and basic technical competence in the field of Computer Graphics and Design. It includes basic concepts of 2D and 3D Graphics. It introduces techniques related to 3D modeling, geometric transformations, surface modeling, 3D viewing and rendering. This course also introduces libraries like OpenGL for advanced integration of computer graphics and object modeling.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	40 / 14	20 / 07	60/ 21	30/10	150 / 52

* **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	4
2	**Graphics Primitives** Output primitives – points and lines, line drawing algorithms, circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes, area-fill attributes, character attributes	8
3	**Two-Dimensional Graphics** Two-dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two-dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two-dimensional viewing functions; clipping operations – point, line and polygon clipping algorithms.	10

4	**Three-Dimensional Graphics** 3D display methods, visible surface detection methods: 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, 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	**8**
5	**Introduction to OpenGL:** OpenGL Primitives, OpenGL Color, glColor and glVertex with Arrays, The Depth Test, 3D Coordinates, Basic 3D Transforms, The Viewport Transformation, The Projection Transformation, The ModelView Transformation, Camera Abstraction, Polygonal Meshes and glDrawArrays, Vectors and Vector Math, Matrices and Transformations, Homogeneous Coordinates.	**5**
6	**Advanced OpenGL:** Introduction to Lighting, Light and Material, Texture Coordinates, MipMaps and Filtering, Texture Target and Texture Parameters, Texture Transformation, Texture Objects, Moving Camera, Moving Lights.	**5**

List of Practicals / Tutorials:

1	Basic Graphics Functions
2	Perform Animation such as Rising Sun, Moving Vehicle, Smileys, Screen saver etc.
3	a) Implementation of Digital Differential Analyser algorithm b) Implementation of Bresenham's line drawing algorithm c)Develop a program to display different types of lines.
4	a)Implement midpoint circle drawing algorithm. b)Implement midpoint ellipse drawing algorithm.
5	a)Implement flood fill algorithm. b) Implement boundary fill algorithm.
6	a) Implementation of 2D Transformations (Translation, Rotation, Scaling, Reflection and Shearing)
7	Implementation of Cohen-Sutherland line clipping algorithm.
8	Implementation of 3D Transformations (Translation, Rotation, Scaling, Reflection and Shearing)
9	Creation of Simple 2D and 3D surfaces using OpenGL
10	Texture mapping on different shapes usingOpenGL
11	Demonstrate Clipping on different shapes using OpenGL
12	Special effects on different objects using OpenGL

13	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, Pearson Education
3	Hearn and Baker, Computer Graphics with OpenGL, Pearson Education
4	Jeffrey McConnell, Computer Graphics: Theory into Practice, Jones and Bartlett Publishers,
5	Madasu Hanmandlu, Computer Graphics, BPB Publication
6	Edward Angel, Interactive Computer Graphics- A Top Down approach with OpenGL, Pearson Education

Supplementary Learning Material:

1. NPTEL - Swayam Courses
2. Coursera Courses

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Seminar/Poster Presentation
- Course Projects

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

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
15%	20%	15%	15%	25%	10%	

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.	**15**
CO-2	To be able to implement appropriate algorithms to draw 2D objects and filling colors.	**25**
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 be able to apply concepts like moving lighting and camera conditions on computer graphic based scenes	**10**

Curriculum Revision:

Version:	**1**
Drafted on (Month-Year):	Apr-23
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	