GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3151607
Semester – V
Subject Name: Computer Graphics and Visualization

Type of Course: Professional Core Course

Prerequisite: Knowledge in Mathematics and basic programming skills.

Rationale:To introduce students with the basic concepts in computer graphics and visualizationand in addition to it clarify the practical view towards the applications of these ideas in engineering and technology.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA(M)	ESE(V)	PA(I)	
3	0	2	4	70	30	30	20	150

Syllabus:

Sr. No.	Content	Hours
1	**Introduction:**History of computer graphics, applications, graphics pipeline, physical and synthetic images, synthetic camera, modeling, animation, rendering, relation to computer vision and image processing, review of basic mathematical objects (Points, Vectors, Matrixmethods).	
2	**Introduction to OpenGL:**OpenGL architecture, primitives and attributes, simple modeling and rendering of two- and three-dimensional geometric objects, indexed and RGB color models, frame buffer, double buffering, GLUT, interaction, events and callbacks,picking	
3	**Geometric Transformations:**Homogeneous coordinates, affine transformations (translation, rotation, scaling, shear), concatenation, matrix stacks and use of model view matrix in OpenGL for these operations	
4	**Viewing:**Classical three dimensional viewing, computer viewing, specifying views, parallel and perspective projective transformations; Visibility- z-Buffer, BSP trees, Open-GL culling, hidden-surface algorithms	
5	**Shading:**Light sources, illumination model, Gouraud and Phong shading for polygons. Rasterization- Line segment and polygon clipping, 3D clipping, scan conversion, polygonal fill, Bresenham's algorithm	
6	**Discrete Techniques:**Texture mapping, compositing, textures in OpenGL; Ray Tracing-Recursive ray tracer, ray-sphere intersection	
7	**Representation and Visualization:**Bezier curves and surfaces, B-splines, visualization, interpolation, marching squares algorithm	

Course outcomes: Students will be able to

Sr. No.	CO Statement	Marks % weightage
1.	**Understand** and **Apply** fundamental concepts within computer graphics such as geometrical transformations, illumination models, removal of hidden surfaces and rendering.	30

2.	**Compare** and **Evaluate**the ideas in some fundamental algorithms for computer graphics	20
3.	**Apply** fundamental principles within interaction programming	30
4.	**Understand** fundamental concepts of information visualization and scientific visualization	20

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**30**	**35**	**10**	**10**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text and References

1. Edward Angel, Interactive Computer Graphics. A Top-Down Approach Using OpenGL (fifth Edition), Pearson Education, 2008
2. Donald Hearn and Pauline Baker, Computer Graphics with OpenGL (third edition), Prentice Hall, 2003
3. F. S. Hill Jr. and S. M. Kelley, Computer Graphics using OpenGL (third edition), Prentice Hall, 2006
4. Peter Shirley and Steve Marschner, Computer Graphics (first edition), A. K. Peters, 2010.
5. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education
6. Xiang, Plastock : Computer Graphics, sham's outline series, 2nd edition, TMG.
7. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning
8. M MRaiker, Computer Graphics using OpenGL, Filip learning/Elsevier

List of Practical:

The practical list shouldinclude minimum 10 practical's covering the complete syllabus.

List of Open Source Software/learning website:

1. https://www.opengl.org/
2. https://learnopengl.com/Getting-started/OpenGL
3. https://developer.nvidia.com/opengl