	Computer Graphics	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basic knowledge about matrix and geometry. Knowledge of C/C++				
Co-requisites					

Course Objectives

1. Learn to create 2D and 3D objects.
2. Able to apply various transformations on the 2D and 3D objects.
3. To apply hidden surface removal techniques along with various shading algorithms
4. Create 3D graphics with realistic effects

Course Outcomes

On completion of this course, the students will be able to:

CO1. Classify various graphics hardware and software devices.
CO2. Use primitive operations to create 2D and 3D objects and perform various operations thereon.
CO3. Perform complex 2D and 3D transformations on objects.
CO4. Implement various hidden surface removal techniques.
CO5. Create 3D realistic imagery by applying shading and colouring techniques on objects.

Catalog Description

This course discusses the theory behind computer graphics and includes many computer graphics algorithms. It is a study of the hardware and software principles of interactive raster graphics. Topics include an introduction to the basic concepts, 2-D and 3-D modelling and transformations, viewing transformations, projections, rendering techniques, graphical software packages and graphics systems. Students will use standard graphics application programming interface (OpenGL) to reinforce concepts and study fundamental computer graphics. The course also includes vertex processing; lighting and shading; rasterization including line and polygon drawing; ray casting; ray tracing, computer graphics in games visualization.

Course Content

UNIT I: 5 Lecture Hours

Introduction to Computer Graphics and OpenGL: Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Introduction to pixel. Why OpenGL, features in OpenGL, OpenGL operations, Abstractions in OpenGL – GL, GLU & GLUT, 3D viewing pipeline, viewing matrix specifications, a few examples and demos of OpenGL programs.

UNIT II: 8 Lecture Hours

Scan conversion – lines, circles and Ellipses; Filling polygons and clipping algorithms

Scan Converting Lines, Mid-point criteria, Aliasing and Antialiasing, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Scan Converting Ellipses, Filling Polygons Clipping Lines algorithms– Cyrus Beck, Cohen-Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components.

UNIT III 10 Lecture Hours

2-D and 3-D Transformations

Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The UNIT Square, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations.

Three-Dimensional Scaling, Three-Dimensional Shearing, Three-Dimensional Rotation, Three-Dimensional Reflection, Three-Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of 3D Transformations.

UNIT IV **8 Lecture Hours**

Rendering

Visible-Surface Determination, Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, the z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison of the methods.

Illumination and Shading Models for Polygons, Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Phong's model, Gouraud shading, some examples.

UNIT V **5 Lecture Hours**

Plane Curves and Surfaces

Curve Representation, Nonparametric Curves, Cubic Splines, , Bezier Curves, Bspline Curves, B-spline Curve Fit, B-spline Curve Subdivision, Parametric Cubic Curves, Quadric Surfaces. Bezier Surfaces, Fractals.

Text Books

1. Donald D. Hearn and M. Pauline Baker (2014), Computer Graphics, Pearson Education India, ISBN: 9788177587654.

Reference Books

1. David F. Rogers and J. Alan Adams, Mathematical Elements for Computer Graphics, McGraw-Hill, Inc

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination

Examination Scheme:

Components	Internal	Mid Term	ESE
Weightage (%)	30%	20%	50%

Relationship between the Course Outcomes (COs), Program Outcomes (POs) and Program Specific Objectives (PSOs)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1											1		
CO2	2	2	2	1									**3**		
CO3	2	2	2	1									**2**		
CO4	2	2	2	1									**2**		
CO5	2	2	2	1									2		
Average	1.8	1.8	2	1									2		

1= Weak 2= Moderate 3= Strong