Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Fourth Year Bachelor of Engineering (IT)

(To be Proposed For: Academic Year 2020-21)

Subject Code: IT703E-N	**Subject Title: Computer Graphics**
Pre-requisite	

Teaching Scheme (Credits and Hours)

Teaching scheme				**Total Credit**	**Evaluation Scheme**					
L	**T**	**P**	**Total**		**Theory**		**Mid Sem Exam**	**CIA**	**Pract.**	**Total**
Hrs	**Hrs**	**Hrs**	**Hrs**		**Hrs**	**Marks**	**Marks**	**Marks**	**Marks**	**Marks**
04	00	02	06	05	03	70	30	20	30	150

Course Objectives:

- This course prepares students for activities involving the design, development, and testing of modeling, rendering, and animation solutions to a broad variety of problems found in entertainment, sciences, and engineering.
- To study and develop interactive programs that uses effectively the graphics functionalities available in contemporary personal computers.
- To study the fundamental principles and technologies upon which these functionalities, and possibly their future evolutions are applicable.
- The skills for designing and implementing practical graphic solutions to challenging problems in different application domains.

Outline of the Course:

Sr. No	**Title of the Unit**	**Minimum Hours**
1	Introduction and Display primitives	13
2	2D Transformations and clipping	14
3	3D-Three Dimensional	13
4	Hidden object and Surface Rendering	13
5	Curves and Surfaces	11

Totalhours (Theory):64
Totalhours (Lab):32
Totalhours: 96

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Detailed Syllabus

Sr. No	Topics	Lecture Hours	Weightage (%)
1	**Introduction and Display primitives** Introduction, Types of computer graphics, Graphic Displays: Random scan displays and Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, ellipse drawing algorithm.	13	20
2	**2D Transformations and clipping** Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms: Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping	14	22
3	**3D-Three Dimensional** 3-D Geometric Primitives, 3-D Object representation, 3-D Transformations, 3-D viewing, projections, 3-D Clipping.	13	20
4	**Hidden objectand Surface Rendering** Back Face Detection algorithm: Depth buffer method, A- buffer method, Scan line method, , Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing Basic illumination models: Ambient light, Diffuse reflection, Specular reflection and Phong model, Intensity Attenuation, Color consideration, Transparency and Shadows.	13	20
5	**Curves and Surfaces** Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, B-spline and Bezier curves and surfaces.	11	18
	Total	64	100

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.

- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

1. Know and be able to discuss hardware system architecture for computer graphics. This includes, but is not limited to: graphics pipeline, frame buffers, and graphic accelerators/co-processors.
2. Know and be able to design and implement model and viewing transformations, the graphics pipeline and an interactive render loop with a 3D graphics API.
3. Know and be able to use the underlying algorithms, mathematical concepts, supporting computer graphics. These include but are not limited to:
    - Composite 3D homogeneous matrices for translation, rotation, and scaling transformations.
    - Plane, surface normal, cross and dot products.
    - Hidden surface detection / removal.
    - Scene graphs, display lists.
4. Know and be able to select and use among models for lighting/shading
5. Know and be able to use and select among current models for surfaces (e.g., geometric; polygonal; hierarchical; mesh; curves, splines).
6. Be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

Be able to discuss future trends in computer graphics and quickly learn future computer graphics concepts and APIs.

E-Resources:

- https://nptel.ac.in/courses/106106090/
- https://nptel.ac.in/courses/106102065/

Reference Books:

1. Computer Graphics C Version, D. Hearn And P. Baker, Pearson Education
2. Computer Graphics, Foley and van Dam, Person Education
3. Computer Graphics with OpenGL, Hearn and Baker, Pearson
4. Computer Graphics, A. P. Godse, Technical Publication

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List of experiments:

No	Name of Experiment
1	To Study and hands on practice of various C Graphics Function
2	Implementation and Using mouse in DOS
3	Implement DDA line algorithm
4	Implement Bresenham's Line algorithm
5	Implement Midpoint Line algorithm
6	Implement Bresenham's Circle Algorithm
7	Implement Mid-point Ellipse algorithm
8	Implement Polygon Filling using Scan Fill, Flood Fill and Boundary Fill Algorithm
9	Implement algorithm of 2D Transformation of an Object
10	Implement Line Clipping using Cohen- Sutherland Algorithm
11	Implement Line Clipping using Liang-Barky algorithm
12	Implement Polygon Clipping using Sutherland-Hodgeman Algorithm