GUJARAT TECHNOLOGICAL UNIVERSITY

INFORMATION TECHNOLOGY

COMPUTER GRAPHICS

SUBJECT CODE: 2151603

B.E. 5th SEMESTER

Type of course: Under Graduate

Prerequisite: C, C++, Linear algebra, Matrices

Rationale: To understand the basics of various inputs and output computer graphics hardware devices as well as the course will offers an in-depth exploration of fundamental concepts in 2D and 3D computer graphics. After introducing 2D raster graphics techniques, the course focuses on 3D modeling, geometric transformations, 3D viewing and rendering. This course presents an introduction to computer graphics designed to give the student an overview of fundamental principles.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Basic of Computer Graphics:** Basic of Computer Graphics, Applications of computer graphics, Display devices, Random and Raster scan systems, Graphics input devices, Graphics software and standards	06	15
2	**Graphics Primitives:** Points, lines, circles and ellipses as primitives, scan conversion algorithms for primitives, Fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes, area-fill attributes, character attributers.	08	20
3	**2D transformation and viewing:** Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping (cohen-sutherland, liang- bersky, NLN), polygon clipping	08	20
4	**3D concepts and object representation:** 3D display methods, polygon surfaces, tables, equations, meshes, curved lies and surfaces, quadric surfaces, spline representation, cubic spline interpolation methods, Bazier curves and surfaces, B-spline curves and surfaces	06	15
5	**3D transformation and viewing:** 3D scaling, rotation and translation, composite transformation, viewing pipeline and coordinates, parallel and perspective transformation, view volume and general (parallel and perspective) projection transformations	08	20
6	**Advance topics:** visible surface detection concepts, back-face detection, depth buffer method,	06	10

	illumination, light sources, illumination methods (ambient, diffuse reflection, specular reflection), Color models: properties of light, XYZ, RGB, YIQ and CMY color models		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	15	10	5	5

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

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.

Reference Books:

1. Computer Graphics, D.Hearn And P.Baker - Pearson Eduction - C Version
2. Computer Graphics, with OpenGL Hearn and Baker, - Pearson
3. Computer Graphics, Sinha & Udai, - TMH
4. Computer Graphics, Foley and van Dam - Person Education

Course Outcome:

After learning the course the students should be able to:

1. To understand the various computer graphics hardware and display technologies.
2. 2D and 3D viewing technologies
3. Various 2D and 3D objects transformation techniques.

List of Experiments:

1. To study the various graphics commands in C language.
2. Develop the DDA Line drawing algorithm using C language
3. Develop the Bresenham's Line drawing algorithm using C language
4. Develop the Bresenham's Circle drawing algorithm using C language
5. Develop the C program for to display different types of lines
6. Perform the following 2D Transformation operation Translation , Rotation and Scaling
7. Perform the Line Clipping Algorithm
8. Perform the Polygone clipping algorithm
9. Perform the following tasks using MATLAB commands.
   - Read the grayscale and color image.
   - Display images on the computer monitor
   - Write images in your destination folder.
10. Generate the complement image using MATLAB.

Design based Problems (DP)/Open Ended Problem:

1. By using the various geometrics transformation techniques, students can develop the various gaming software and also able to perform the animation concept.

Major Equipment:

1. Computer systems with high RAM.

List of Open Source Software/learning website:

1. GIMP - GNU Image Manipulation Program
2. Inkscape - Open Source vector graphics editor
3. C Compiler

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.