CSE4042: Computer Graphics (CG)

Programme: B.Tech. (CSE) Year: 3rd/4th Semester: 5th
Course : Program Elective Credits : 3 Hours : 40

Course Context and Overview (100 words):
Computer graphics deals with the study of technology and techniques for generating and displaying images of natural and synthetic objects. It is an exciting field with a wide range of applications including entertainment, graphical user interfaces, industrial modeling, molecular modeling, surgery planning, virtual reality, and visualization. This course will introduce the basic principles, concepts, and algorithms in computer graphics. Students will learn mathematical and computational techniques for modeling, representing, and displaying 3D geometric objects

Prerequisites Courses: Computer Programming CSE 104, Data Structures CSE 215, Linear & Matrix Algebra

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1 : Understand 2D graphics and algorithms including: line drawing, polygon filling, clipping, and transformations. They will be able to implement these.
CO2 : Understand the concepts of and techniques used in 3D computer graphics
CO3 : Use a current graphics API (OpenGL)
CO4 : Implement visibility detection and other advanced graphic techniques.

Course Topics:

Topics	Lecture Hours	
UNIT – I Introduction **1. Topic**		
1.1 Introduction to CG	1	2
1.2 Graphics Programming- Open GL	1	
UNIT – II Graphics Primitives **2. Topic**		4
2.1 Drawing Primitives (Drawing Lines & Curves) : Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms	2	
2.2 Filled area primitives: Scan line polygon fill	2	

algorithm, boundary-fill and flood-fill algorithms		
UNIT – III 2-D Graphics **3. Topic**		11
3.1 Matrix representations and homogeneous coordinates, 2-D Geometric Major transformations: Translation, scaling, rotation, reflection and shear transformations, composite transforms.	4	
3.2 2-D viewing: The viewing pipeline, viewing coordinate reference frame, window to viewport coordinate transformation, viewing functions, Cohen-Sutherland, Mid-Point subdivision and Cyrus-beck line clipping algorithms.	7	
UNIT - IV 3 D Graphics **4. Topic**		12
4.1 3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.	3	
4.2 3-D Viewing Transformations: Parallel Projection: Orthographic, Axonometric, Cavalier and Cabinet. Perspective Projection: one point, two point, three point perspective projection, vanishing point.	5	
4.3 3-D object representation: Polygon surfaces, quadric surfaces, spline representation, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Polygon rendering methods	4	
UNIT-V Miscellaneous Topics in CG **5. Topic**		11
5.1 Visible surface detection methods: Classification, back-face detection, depth-buffer, scan -line, depth sorting, BSP-tree methods, area sub-division and octree methods	4	
5.2 Illumination models, Gouraud shading, Phong shading, transparency, shadows, texture. Color Models	7	

Textbook references (IEEE format):
Text Book:

1. Donald Hearn and M.Pauline Baker, "*Computer Graphics C version*", Pearson Education
2. Peter Shirley & Steve Marschner, *"Fundamentals of Computer Graphics"*, Taylor & Francis

Reference books:

1. David F. Rozers, "*Procedural Elements for Computer Graphics*" TMH.
2. Foley, J.D., A. Van Dam, S. Feiner, and J. Hughes, "*Computer Graphics: Principles and Practice*", Addison-Wesley

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):

Evaluation Methods:

Item	Weightage
Assignments	10
Quizzes	10
Regularity	10
Midterm	25
Final Examination	40

Prepared By:
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