University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** IV	
Subject: Computer Graphics (Abbreviated as CG)			
Periods per Week (each 60 min.)	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical & Oral	02	25
	Oral	-	-
	Term Work	-	25
	Total	05	150

Module	Contents	Hours
1	**Basic Concepts** 1. Introduction to computer Graphics 2. lines, line segments, vectors, pixel and frame buffers, vector generation 3. DDA and Bresenham's line drawing algorithms. 4. Mid point and Bresenham's circle drawing algorithms. 5. Mid point ellipse drawing algorithm. 6. Various styles of lines like thick lines 7. Character generation methods Stroke principle, Bitmap method 8. Display file structureDisplay file interpreter.	06
2	**Polygons** 1. Introduction 2. Representation of polygon 3. Entering polygons in display file 4. inside-outside test 5. Polygon filling methods • Boundary fill • Flood fill • Scan line polygon Fill • Patterns filling **Transformations** 1. homogeneous coordinates 2. Translation 3. Scaling 4. Rotation	10

	5. Rotation about arbitrary point 6. inverse transforms 7. shear transforms 8. Reflections.	
3	**Segmenets** 1. Introduction 2. segment table 3. operations segment • creation • closing • deletion • renaming • Visibility 4. Other display-file structures 5. Image transformations 6. Raster techniques **Windows and Clipping** 1. Introduction 2. viewing transforms 3. 2D line clipping • Cohen-Sutherland line clipping • Midpoint subdivision algorithm • Liang-Barsky Line clipping algorithms • Cyrus-Beck algorithm 4. Text Clipping 5. Polygon Clipping • Sutherland-Hodgman polygon clipping algorithm • Weiler-Arthorton polygon clipping • Liang-Barsky polygon clipping 6. Generalized clipping	08
4	**3-D Transformations** 1. Introduction 2. 3-D geometry 3. 3-D display methods 4. 3-D object representation methods 5. 3-D transformations 6. Rotation about an arbitrary axis 7. Concept of parallel and perspective projections 8. 3-D clipping 9. 3-D viewing transformatios	08
5	**Hidden Surfaces and Lines** 1. Introduction 2. Back-face removal algorithm 3. Z buffers 4. scan-line	

	5. painter's algorithm 6. Warnock's algorithm 7. Hidden line methods **Light , Color and Shading** 1. Introduction 2. Diffuse illumination 3. Point Source illumination 4. Specular reflection 5. Shading algorithms 6. transparency 7. reflections 8. shadows 9. ray tracing 10. color models 11. rendering pipeline	08
6	**Curves and fractals** 1. Introduction 2. Curve generation • B-Splines • Bezier curves 3. Surfaces • Bezier surfaces • B-Splines surfaces **Animation** 1. Devices for producing animation 2. Computer assisted animation 3. real time animation 4. frame-by-frame animation 5. method for controlling animation(fully explicit control, procedural)	08

Term Work

1. Journal should consist of at least 10 Experiments based on above syllabus.
2. One written test should be conducted in the semester for the weight age of 10 Marks
3. Suggested list of Experiments based on which practical examination should be conducted.
    1. DDA / Bresenham's line algorithm with various styles like thick, dotted etc. (Make use of Display File concept)
    2. Circle drawing using Bresenham's or midpoint algorithm.
    3. Various 2-D transformations(Scaling, Rotation, Translation etc.) implementation. Use metrices multiplications for implementation.
    4. various polygon filling methods like Pattern fill, Flood fill, Boundary fill.
    5. 2 D curves and surfaces drawing like Bezier, B spline.
    6. Line clipping- Liang Barsky, cohen-Sutherland
    7. Polygon clipping- Sutherland Hodgman

8. 3 D transformations
9. Fractals
10. Character Generation

Implementation of these experiments can be done in c/c++/java

Practical exam of 25 marks should be based on this list of experiments.

4. Mini. Projects: Journal should include 2 Mini projects as a part of term work

(Mini project is not part of practical exam)
(Concerned staff should form group of at most 3 students)
Suggested mini project topics are

a. Graphics Editor
b. Displaying given 3D object using perspective projection
c. 3D modeling of objects using OpenGL
d. Implementing any shading algorithms using OpenGL.
e. Surface rendering using OpenGL

6. Journal should also have at least 3 assignments based on above syllabus.

Text Books

1) S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987 ISBN 0-07-100472-6
2) J. Foley, Van Dam, S. Feiner, J. Hughes, " Computer Graphics Principles and Practice", 2nd Edition , Pearson Education, 2003, ISBN 81-7808-038-9
3) Leen Ammeraal, KangZRang "Computer Graphics for Java Programming",2nd Edition, Wiley India

Reference Books

1) D. Rogers, "Procedural elements for computer Graphics", 2nd Edition, TATA McGraw-Hill Publications,2001, ISBN0-07-047371-4
2) D. Hearn, M. Baker , "Computer Graphics-C Version", 2nd Edition, Pearson Education, 2002, ISBN 81-7808-794-4
3) F. Hill, "Computer Graphics: Using OpenGL", 2nd Edition, Pearson Education, 2003, ISBN 81-297-0181-2
4) Xiang, Plastock,"Computer Graphics", 2nd Edition, TATA McGraw-Hill Publications,2002, ISBN-0-07-049958-6