



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

COMPUTER GRAPHIC								
V Semester: IT								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AITD09	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 48			
Prerequisite:								

I. COURSE OVERVIEW:

Computer graphics is one of the fundamental aspects of any computing system. The fundamental concepts and algorithms that underpin computer graphics are covered in this course, along with a brief overview of more advanced subjects like computer animation, image-based rendering, and global illumination. 2D and 3D geometrical transformations. Other topics covered include surface shading, ray tracing, hidden surface elimination algorithms, triangle and polygon rasterization, line drawing algorithms, circle/ellipse drawing algorithms and additionally, Installation of software supporting to OpenGL and executing practical programs.

II. COURSE OBJECTIVES:

The students will try to learn:

- The basic components and technologies of computer graphics systems, including display devices, input devices, and graphics software.
- How to perform and apply 2D and 3D geometric transformations using matrix-based techniques to manipulate and render graphical objects.
- The principles of scan conversion, clipping, and interactive graphics programming using OpenGL for real-time graphics development.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

- CO1 Understand historical evolution, issues and challenges, graphics pipeline, hardware and software basics
- CO2 Interpret Object representation - boundary representation, splines, space partitioning
- CO3 Make use of Modeling transformations - matrix representation, homogeneous coordinate system, composition, 3D transformations
- CO4 Make use of Clipping and hidden surface removal - clipping in 2D. 3D clipping algorithms, hidden surface removal
- CO5 Make use Rendering - scan conversion of line, circle, fill-area and characters, anti-aliasing
- CO6 Develop Graphics hardware and software - generic architecture, I/O, GPU, Shader programming, graphics software (OpenGL)

IV. COURSE CONTENT:

MODULE – I: 1 INTRODUCTION TO COMPUTER GRAPHICS (10)

Overview of Computer Graphics, Computer Graphics Application and Software, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random Scan Display Processor, LCD displays.

MODULE – II: TWO-DIMENSIONAL [2D] TRANSFORMATION (10)

Transformations and Matrices, 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, Solid Body Transformations, Rotation About an Arbitrary Point, The Window-to-Viewport Transformations.

MODULE – III: THREE-DIMENSIONAL[3D] TRANSFORMATIONS (10)

Introduction, 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, Affine and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views.

MODULE – IV: SCAN CONVERSION (09)

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

MODULE – V: GRAPHICS PROGRAMMING USING OPENGL (09)

Graphics hardware and software, Introduction and need of 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.

V. TEXT BOOKS:

1. D. Hearn and M. Pauline Baker, *Computer Graphics (C Version)*, Pearson Education, 2nd Edition, 2004.
2. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, *Computer Graphics – Principles and Practice*, Second Edition in C, Pearson Education, 2003.

VI.REFERENCE BOOKS:

1. D. F. Rogers and J. A. Adams, *Mathematical Elements for Computer Graphics*, 2nd Edition, McGraw-Hill International Edition, 1990.
2. F. S. Hill Jr., *Computer Graphics using OpenGL*, Pearson Education, 2003.

VII. ELECTRONICS RESOURCES:

1. <https://www.geeksforgeeks.org/introduction-to-computer-graphics/>
2. <https://swayamopenid.b2clogin.com/swayamopenid.onmicrosoft.com>

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper - II
9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation

