| Semester: 5 | BCA504D | 2D and 3D Graphic Design [Theory & Practical] |
|---|---|---|
| 4 Credits | TPE: 3:2:0 | Discipline Specific Elective -DSE |

**Course Outcomes:** On successful completion of the course the learner will be able to

| CO# | Course Outcomes |
|---|---|
| BCA504D.1 | Define and explain the fundamental concepts of 2D and 3D graphics. |
| BCA504D.2 | Identify various 2D and 3D transformations. |
| BCA504D.3 | Analyze the impact of different transformations on graphical elements. |
| BCA504D.4 | Implement linear and affine transformations in 3D graphics. |

**Module I: Introduction to 2D and 3D graphics** **9 Hours**

Introduction, display devices- introduction to CRT, flat panel displays and their working, stereoscopic 3D displays. Overview of Cartesian Coordinate system. Geometric Data Types, Vectors, coordinate vectors and Bases. Basic Lighting and Reflection, Simple Reflection Models – Diffuse, Perfect Specular, General Specular. Shading – Flat Shading, Interpolative shading, shading in OpenGL, Texture Mapping, Aliasing. Ray Tracing and Path Tracing

**Module II: 2D Transformations** **9 Hours**

Attributes – Line attributes, curve attributes, colour and grayscale levels, area fill attributes, character attributes. Two Dimensional Transformation – Basic Translate, rotate, scaling, Matrix representations and Homogenous Coordinates Other transformations – Shear, reflection. Composite transformations between coordinate systems

**Module III: 2D Viewing & Clipping** **9 Hours**

Two Dimensional viewing: The Viewing pipeline, viewing coordinate reference frame. Window-to-Viewport Coordinate Transformation. Transformations in Open GL Clipping operations, point clipping, line clipping- Cohen Sutherland line clipping, polygon Clipping- Sutherland-Hodgeman Polygon clipping

**Module IV: 3D Transformations** **9 Hours**

Linear Transformations and 3 by 3 Matrices, Rotations, Scales. Affine – points and frames, Affine Transformations and 4 by 4 Matrices, applying Linear transformations to points, translations. Frames in Graphics – World Object and Eye Frame, Moving things around, Hierarchy. 3D World – Coordinates and Matrices, Drawing a Shape

**Module V: Pygame** **9 Hours**

Introduction, Pygame libraries, import and initialize modules, window – create, size, resize, change window name, screen background color. Display modes, Colour Object, Event Objects, Keyboard events, Mouse events, Drawing Shapes, Load image, displaying a text in Window, Moving an image - with numeric key pads, mouse. Moving a rectangular objects, Use text as buttons, Transforming images, Set up a game loop, Surface – Create, load an image on surface. Time module, Load cursor. Errors and Exceptions. PyOpenGL – Elements of OpenGL and its functions

**Reference Books**:


1. Foundations of 3D Computer Graphics Steven J. Gortler, MIT Press, 2012
2. Introduction to Computer Graphics Version 1.4, August 2023 David J. Eck Hobart and William Smith Colleges.
3. Beginners guide to Graphic Design with freelance designer Gareth David.
4. Practical Algorithms for 3d Computer Graphics, R Stuart Ferguson, Second Edition, CRC Press.