**UCS505: COMPUTER GRAPHICS**

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**Course Objectives:** This course provides an introduction to the principles of computer graphics. It covers detailed study of computer graphics fundamentals, 2-D & 3-D geometric transformations, curve design, visible surface detection and illumination models.

**Fundamentals of Computer Graphics:** Applications of computer Graphics in various fields, Evolution of computer Graphics, Graphical Input-Output Devices, Random scan displays, Raster scan displays.

**Graphics Primitives:** Algorithms for drawing various output primitives - Line, circle, ellipse, arcs & sectors, Boundary Fill & Flood Fill algorithm, Color Tables.

**2-D & 3-D Geometrical Transformations:** Translation, Rotation, Scaling, Shear, Reflection, Homogenous coordinate system, Composite transformations.

**Viewing &Clipping in 2-D:**Window to View port transformation, Cohen Sutherland, Liang Barsky, Nicholl-Lee-Nicholl Line clipping algorithms, Sutherland Hodgeman, Weiler Atherton Polygon clipping algorithm.

**Three Dimensional Viewing & Clipping:** 3-D Viewing, Projections, Parallel and Perspective projections, Clipping in 3-D.

**Curves& Surfaces:** Curved Lines & surfaces, Interpolation & Approximation splines, Parametric & Geometric Continuity conditions, Bezier Curves & surfaces, B-spline curves & surfaces.

**Visible Surface Detection Methods:** Classification of visible surface detection algorithms, Depth buffer method, Scan-line method, Depth-Sorting method, Subdivision Algorithm.

**Illumination Models & Surface Rendering:** Light sources, Illumination models, Surface Rendering methods, Basic Ray tracing algorithm.

**Laboratory work:**

Laboratory work should be done in OpenGL (version 3+). Covers all the basic drawing, filling, 2D & 3D transformations, clipping, and curve generation.

**Course Learning Outcomes (CLOs)/ Course Objectives (COs):**

After the completion of the course, the student will be able to:

1. Comprehend the concepts related to basics of computer graphics and its applications in various fields.
2. Apply algorithms to scan convert various output primitives and alters the coordinate descriptions of objects using 2-D & 3-D geometric transformations.
3. Understand and apply various concepts of viewing & clipping in 2-D & 3-D.
4. Comprehend the concepts related to curve design and identify visible surfaces in three dimensional scene using visible surface detection methods.
5. Apply OpenGL to create various primitives of computer graphics.

**Text Books:**

1. *Donald D Hearn, M. Pauline Baker, “Computer Graphics, C version”, 2nd Edition, Pearson Education (1997).*
2. *James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, “Computer Graphics: Principles & Practice in C”, Second Edition, Addison Wesley Longman (1995).*

**Reference Books:**

1. *Donald Hearn and M Pauline Baker, “Computer Graphics with OpenGL”, Pearson education, 2004.*
2. *Zhigang Xiang, Roy A Plastock, “Computer Graphics”, Schaums Outline, TMH (2007).*
3. *Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis, “OpenGL Programming Guide: The Official Guide to Learning OpenGL” (2013).*

**Evaluation scheme**

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| **Sr. no.** | **Evaluation Elements** | **Weights**  **(%)** |
| 1. | MST | 25 |
| 2. | EST | 45 |
| 3. | Sessionals (May include Assignments/Projects/Tutorials/Quiz/Lab evaluations) | 30 |