Computer Graphics

**Course Objectives:**  
To familiarize with graphics hardware, line and curve drawing techniques, techniques for representing and manipulating geometric objects, illumination and lighting models. .

1. **Introduction and application  [2 hours]**  
   History of computer graphics, Applications of computer graphics, Hardware: Raster-Scan Displays, Vector Displays, Hard copy devices, Input Hardwares, Display Architectures, Applications in various fields like medicine, engineering, art, uses in virtual realism.
2. **Scan-Conversion [6 hours]**
   1. Scan-Converting A Point
   2. Scan-Converting A Straight Line: DDA Line Algorithm, Bresenham's Line Algorithm
   3. Scan-Converting a Circle and an Ellipse: Mid-Point Circle and Ellipse Algorithm
3. **Two –Dimensional Transformations  [6 hours]**
   1. Two –dimensional translation, rotation, scaling, reflection, shear transforms
   2. Two-dimensional composite transformation
   3. Two-dimensional viewing pipeline, world to screen viewing transformations and clipping (Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping)
4. **Three-Dimensional Graphics   [6 hours]**
   1. Three –dimensional translation, rotation, scaling, reflection, shear transforms
   2. Three-dimensional composite transformation
   3. Three-dimensional viewing pipeline, world to screen viewing transformation, projection concepts (orthographic, parallel, perspective projections)
5. **Curve Modeling  [4 hours]**  
   Introduction to Parametric cubic Curves, Splines, Bezier curves
6. **Surface modeling         [4 hours]**  
   Polygon surface, vertex table, edge table, polygon table, surface normal and spatial orientation of surfaces
7. **Visible Surface Determination   [6 hours]**
   1. Image Space and Object Space techniques
   2. Back Face Detection, Z-Buffer, A-Buffer, Scan-Line method
8. **Illumination and Surface Rendering methods       [8 hours]**
   1. Algorithms to simulate ambient, diffuse and  specular  reflections
   2. Constant , Gouraud and phong shading models
9. **Introduction to Open GL [3 hours]**  
   Introduction to OpenGl, callback functions, Color commands, drawing pixels, lines, and polygons using OpenGL, Viewing, Lighting.

**Practical:**  
There shall be 5 to 6 lab exercise including following concepts:

1. DDA Line Algorithm
2. Bresenham’s Line algorithm
3. Mid Point Circle Algorithm
4. Mid Point Ellipse Algorithm
5. Lab on 2-D Transformations
6. Basic Drawing Techniques in OpenGL

**Text Book**:  
Donald Hearn and M. Pauline Baker, “*Computer Graphics C version (2nd edition)*”

**Reference**

1. Donald D. Hearn and  M. Pauline Baker, *“Computer Graphics with OpenGL (3rd Edition)”*
2. Foley, Van Dam, Feiner, Hughes *“Computer Graphics Principles and Practice (Second Edition in C”)*

**Evaluation Scheme:** The question will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

|  |  |  |
| --- | --- | --- |
| **Chapter** | **Hours** | **Mark Distribution\*** |
| 1 | 2 | 4 |
| 2 | 6 | 10 |
| 3 | 6 | 10 |
| 4 | 6 | 10 |
| 5 | 4 | 8 |
| 6 | 4 | 8 |
| 7 | 6 | 10 |
| 8 | 8 | 14 |
| 9 | 3 | 6 |
| **Total** | **45** | **80** |

**\*Note: There may be minor deviation in marks distribution.**