Q.1  

a. Write the open GL commands to plot three equally spaced points along a two-dimensional straight line path with a slope of 2.

b. What are quadric surfaces? Write the equation of a sphere in Cartesian and spherical coordinates \((r, \theta, \phi)\).

c. Obtain the matrix that represents two dimensional translation by factors \(l_x\) and \(l_y\) along x and y axis respectively.

d. What is morphing? Show by a diagram transformation of a triangle into a quadrilateral using linear interpolation.

e. What is the combined effect of rotation through 90° followed by reflecting along the line \(y = -x\) on the line segment joining (2, 2) and (4, 4)?

f. What are sweep translations? Explain.

g. Are squares self-similar? Are hexagons or a circle self similar? Draw examples to justify your answer.

Q.2  

a. Write a routine for the DDA line drawing algorithm. Also explain the algorithm using a suitable example.

b. Find the pixel location approximating the first octant of a circle having a centre (2, 3) and a radius of 2 units using Bresenham circle algorithm. Use this to plot the complete circle on a Cartesian graph representing pixel grids.

Q.3  

a. Explain the steps involved in rotating an object about an axis that is not parallel to x-axis. Draw appropriate diagrams.
b. The following figure represents a house in the xy-plane.

The house is to be rotated about the point $P_1$ through an angle $\theta$ in the counter clockwise direction. Write the sequence of three fundamental transformations required to do this. Obtain the corresponding composite matrix and illustrate each step through pictures.

Q.4  

a. Use Cohen-Sutherland line clipping algorithm to clip the line EI given below. 

b. Clip the line $P_1P_2$ shown in the figure below using Cyrus-Beck clipping algorithm.
Q.5  a. What do you understand by vanishing points for perspective projections? Clearly explain with the help of diagrams the concept of one-point and two-point perspective projection.  

b. Write a short note on orthogonal projection of an object. Illustrate your answer with the help of appropriate diagrams.  

Q.6  a. Explain the Back-Face detection method for locating the back faces of a polyhedron. Illustrate with the help of suitable diagrams.  

b. Describe the scan-line method for identifying visible surfaces of a polyhedron.  

Q.7  a. Write a short note on Hermite splines.  

b. Explain the Gouraud surface rendering method.  

c. Find the equation of the Bezier curve which passes through (0, 0) and (-4, 2) and controlled through (14, 10) and (4, 0).