Q.1  a. Provide four examples each for Input and output devices used in Computer Graphics. Briefly describe technical specification of any one of them.

b. How half toning is useful in anti-aliasing?

c. Write the seed fill algorithm. How to find seed point before running the algorithm?

d. Compute rotation matrix for rotating \((x, y, z)\) by an angle \(\theta\) about Y-axis.

e. What is knot and knot vector? Why is it considered in B-spline curves?

f. Briefly explain the application of Union & Intersection operations in representation of solid in Computer Graphics.

g. Define ambient light source and give formula for the intensity of ambient light at a point. \((7 \times 4)\)

Q.2  a. How a TFT display device works? What is source of light in a TFT display? \((6)\)

b. (i) Write Bresenhem’s circle drawing algorithm. Why co-ordinates of only one eighth of the total pixels lying on circumference of a circle are computed? How coordinates of other pixels are computed? \((8)\)

(ii) Write digital differential analyzer algorithm for line drawing. \((4)\)

Q.3  a. Write the scan line fill algorithm and use the algorithm to fill polygon bounded by lines joining vertices: \((1, 1), (2, 3), (4, 2)\) and \((5, 1)\). \((9)\)

b. Use Cohen-Sutherland algorithm to clip the line \(P_1 (1, 2)\) to \(P_2 (8, 5)\) with respect to the clipping window given by \(0 \leq x \leq 7, 0 \leq y \leq 4\). \((9)\)
Q.4  
   a. Deduce a matrix to shear an object by unit 5 along X – axis and then by unit 4 along Y – axis.  
      (6)  
   b. What is affine transformation? What features of an object are retained after transforming it from one reference frame to another?  
      (6)  
   c. How a vanishing point is related to perspective projection? Can we think of a perspective projection without a vanishing point?  
      (6)  

Q.5  
   a. Find the transformation matrix for projecting a 3D object in Y-Z plane where object is viewed from positive X-axis side and object is lying in the first octant.  
      (10)  
   b. Determine a formula for computing intensity of light at a point (x, y) on a surface using Phong shading.  
      (8)  

Q.6  
   a. Compare Z- Buffer algorithm and Depth sort algorithm for back face culling.  
      (9)  
   b. Write the BSP algorithm for removal of hidden surfaces.  
      (9)  

Q.7  
   Write short notes on any TWO of the following:  
      (i) Mandelbrot Set  
      (ii) Rendering Process  
      (iii) Importance of in-between Key-frame  
      (9+9)