1. (a) What is staircase effect? Do you agree with the statement “Staircase effect facilitates smooth line generation”? Justify your answer with suitable arguments.  

(b) Compare and contrast the 2D Euclidean coordinate system with the 2D Homogeneous coordinate system with the help of an example.  

(c) Determine the perspective projection of point \( P(x, y, z) \) on \( z = 0 \) plane, where the centre of projection is at \( E(0, 0, -10) \).  

(d) How does frame buffer differ from the display buffer? How does frame buffer overcome the limitation of display buffer?
(e) Prove the following properties of a Bezier curve:
(i) \( P(u = 0) = p_0 \)
(ii) \( P(u = 1) = p_n \)

where \( u \) is the parameter and \( p_0 \) and \( p_n \) are the zeroth and \( n^{th} \) control points, respectively.

(f) How does frame spacing influence the simulation of acceleration in an animation? Justify your answer with suitable illustrations.

(g) Differentiate between window and viewport region? Explain how window to viewport mapping is performed.

(h) What is Aliasing? Explain how Antialiasing overcomes the problem of Aliasing.

2. (a) Write the pseudocode for Bresenham circle generation algorithm, and use it to produce an arc of radius \( r = 4 \) units, in the first quadrant from \( x = 0 \) to \( x = y \).

(b) Differentiate between scan line polygon fill algorithm and flood fill algorithm.

(c) Differentiate between Parallel projection and Perspective projection.
3. (a) Determine the final coordinates of the perspective projection of an object, when the object is first rotated w.r.t. y-axis by 30° in clockwise direction and then w.r.t. x-axis by 45° in clockwise direction and finally it is projected on to z = 0 plane with the centre of projection at (0, 0, —5).

(b) Show that 2D rotational transformations are commutative in nature i.e. \( R_1 \cdot R_2 = R_2 \cdot R_1 \).

(c) Explain all the four cases of Sutherland-Hodgman polygon clipping algorithm, with suitable examples.

4. (a) Formulate the mathematical function, to regulate the frame spacing, for simulating

(i) Zero acceleration motion,

(ii) Negative acceleration motion.

(b) Explain any two of the following:

(i) Cel Animation

(ii) Frame Animation

(iii) Sprite Animation

(c) Briefly discuss the different polygon representation methods.
5. (a) Expand the following abbreviations of file formats:

(i) GIF
(ii) JPEG
(iii) MPEG
(iv) TIFF
(v) BMP

(b) Explain any two of the following:

(i) Compression in digital video
(ii) Authoring tools
(iii) Morphing

(c) Write the pseudocode for Z-buffer algorithm for visible surface detection. What is the maximum number of objects that can be handled by Z-buffer algorithm? Give two advantages and two disadvantages of Z-buffer algorithm.