(3 Hours) **[Total Marks: 80]**

N.B.: (1) Question No.1 is compulsory.
(2) Answer any three questions from Q.No. 2 to Q.No. 6
(3) Figures to the right indicate full marks
(4) Assume suitable data if required

Q.1 a. Differentiate between Bitmap and Vector based graphics [5]
b. Explain inside-outside test [5]
c. Explain graphical rendering pipeline [5]
d. Explain Java 3D [5]

Q.2 a. Draw Bezier curve of order 3 having 4 control points (1, 1), (2, 3), (4, 3) and (6, 4) [10]
b. What are the applications of Virtual Reality? [10]

Q.3 a. Explain Cohen Sutherland line clipping algorithm. Hence find the clipping Coordinates of line AB where A (-1, 5), B (3,8). Window coordinates are (-3, 1) and (2, 6) [10]
b. Explain types of projections. [10]

Q.4 a. Explain 2D reflection transformation with respect to arbitrary axis [10]
b. Explain Midpoint circle drawing algorithm [10]

Q.5 a. Explain 3D rotation with respect to arbitrary axis which is not parallel to x, y and z axis [10]
b. Explain VRML [5]
c. Find normalization transformation matrix in which window has lower left corner at (1, 1) and upper right corner at (6,6) which is mapped to the viewport where viewport is a normalized device screen. [5]

Q.6 Write short note on:
a. Types of VR Systems [5]
b. Text clipping [5]
c. Koch curve [5]
d. Mesh Warping [5]