Roll No. _____ **8 December 2026**

UCS505: Computer Graphics Time: **3 hours** MM:**45**

Faculty: ANG,AMK,HPS

Riverside Institute of Technology

Computer Science & Engineering Department

END SEMESTER EXAMINATION

Instructions:

1. Attempt any 5 questions;
2. Attempt all the subparts of a question at one place.

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1. a) Given the control polygon $\mathbf{b}_0, \mathbf{b}_1, \mathbf{b}_2, \mathbf{b}_3$ of a Cubic Bezier curve; determine the coordinates for parameter values $\forall t \in T$. [7 marks]

$$T \equiv \{0, 0.15, 0.35, 0.5, 0.65, 0.85, 1\}$$

$$\begin{bmatrix}\mathbf{b}_0 & \mathbf{b}_1 & \mathbf{b}_2 & \mathbf{b}_3\end{bmatrix} \equiv \begin{bmatrix}1 & 2 & 4 & 3\\ 1 & 3 & 3 & 1\end{bmatrix}$$

   b) Explain the role of the convex hull property in bounding a Bezier curve. [2 marks]

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2. a) Describe the continuity conditions (C^0, C^1, C^2) for curvilinear geometry. [5 marks]
   b) Define formally, a B-Spline curve. [2 marks]
   c) How is a Bezier curve different from a B-Spline curve? [3 marks]

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3. a) Given a triangle, with vertices defined by column vectors of P; find its vertices after reflection across the XZ plane. [3 marks]

$$P \equiv \begin{bmatrix}3 & 6 & 5\\ 4 & 4 & 6\\ 1 & 2 & 3\end{bmatrix}$$

   b) Given a pyramid with vertices defined by the column vectors of P, and an axis of rotation A with direction $\mathbf{v}$ and passing through $\mathbf{p}$, find the coordinates of the vertices after rotation about A by an angle of $\theta = \pi/4$. [6 marks]

$$P \equiv \begin{bmatrix}0 & 1 & 0 & 0\\ 0 & 0 & 1 & 0\\ 0 & 0 & 0 & 1\end{bmatrix}$$

$$\begin{bmatrix}\mathbf{v} & \mathbf{p}\end{bmatrix} \equiv \begin{bmatrix}0 & 0\\ 1 & 1\\ 1 & 0\end{bmatrix}$$

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4. a) Explain the two winding-number rules used for inside/outside tests in polygon filling. [4 marks]
   b) Explain the working principle of a CRT display. [5 marks]

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5. a) Given a projection plane P defined by normal $\mathbf{n}$ and a reference point $\mathbf{a}$, and the centre of projection as $\mathbf{p}_0$, find the perspective projection of the point $\mathbf{x}$ onto P. [5 marks]

$$\begin{bmatrix} \mathbf{a} & \mathbf{n} & \mathbf{p}_0 & \mathbf{x} \end{bmatrix} \equiv \begin{bmatrix} 3 & -1 & 1 & 8 \\ 4 & 2 & 1 & 10 \\ 5 & -1 & 3 & 6 \end{bmatrix}$$

b) State the two main differences between a perspective projection and a parallel (orthographic) projection. [2 marks]