Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Sem-I Examination January 2010

Subject code: 710202 Subject Name: Advanced Computer Graphics

Date: 22 / 01 /2010 **Time:12.00 – 2.30 pm**

Total Marks: 60

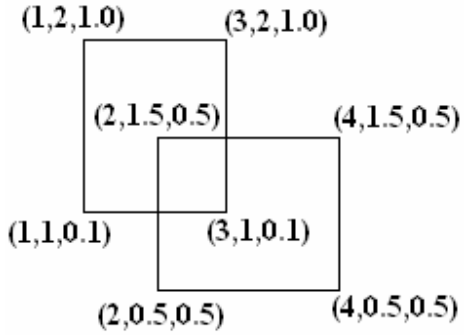
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q 1	**a**	Consider a unit cube with one of the two opposite diagonals is located at (0, 0, 0) and (1, 1, 1). The cube is rotated about the X-axis by 30° and projected on to the z=0 plane with the center of projection at zc=4. Prove that it is two point perspective projections. Also find the principal vanishing points.	**06**
	b	Mention the advantages of B-spline over Bezier curve. Prove that C^2 continuity is inherent in uniform cubic B-spline. Blending functions for B-spline curve are $B03=(1-t)^3/6$, $B13 = (3t^3-6t^2+4)/6$, $B23 =(-3t^3+3t^2+3t+1)/6$ $B33=t^3/6$	**06**
Q2	**a**	Derive the transformation matrix for Isometric parallel projection. Prove that foreshortening factor $f=0.8165(\sqrt{2}/3)$ and projected x-axis makes ±30 degrees with horizontal.	**06**
	b	Derive the equation for Bezier surface. Find condition for C^1 continuity between two Bezier surface patches.	**06**
		OR	
	b	Discuss the effect of multiple control points on a uniform non-rational B-spline curve. Also discuss the effect of multiple knots on non-uniform non-rational B-spline. Draw necessary diagram in both the cases.	**06**
Q 3	**a**	What are the differences between regularized Boolean set operations and ordinary Boolean set operations? Define regularized Boolean operations ($U^*,\cap^*,-^*$) in terms of ordinary Boolean operations. Mention the properties of solid modeling techniques.	**06**
	b	Explain Halftone approximation with its applications in detail.	**06**
		OR	
Q 3	**a**	Define polyhedra. What is the necessary and sufficient condition for object to be a polyhedron? Mention the advantages of Winged-edge representation over other boundary representation methods.	**06**
	b	How do we find dominant wavelength and excitation purity of any color using CIE diagram? Briefly explain YIQ color model with its applications.	**06**
Q 4	**a**	What are the advantages of binary space partition (BSP Tree) algorithm over other list priority algorithm? With example explain BSP Tree construction. Also explain the BSP tree traverse algorithm to get a correct priority ordered polygon list.	**06**
	b	Discuss Back face Culling as visible surface determination algorithm. For the pyramid having vertices A(0,0,0), B(0,0,1), C(1,0,0) and D(0,1,0), apply back face culling and find out visible surfaces. Assume viewing direction is –i-j-k.	**06**

OR

Q 4	**a**	With example discuss Octree as visible surface determination algorithm.	**06**
	b	Briefly explain weiler-atherton visible surface detection algorithm. Apply algorithm on following figure and find out visible surfaces.	**06**



Q 5	**a**	Consider triangle with coordinates A(1,1,2), B(6,1,2) and C(3,3,2). Apply phong illumination model at centroid of triangle and find out the intensity at centroid. Light source position is (1,0,0), viewing direction V = i+j+k, Fatt = 1, Ks = 0.8, Ia = 1, Ip = 10, Kd = Ka = 0.15 and n = 3.	**06**
	b	What is the difference between local illumination and global illumination? Briefly explain recursive ray tracing global illumination algorithm with necessary diagram. Give illumination equation in recursive ray tracing method of global illumination.	**06**

OR

Q 5	**a**	Define rendering. Compare geometry based, image based and Point based rendering techniques. Discuss rendered animation.	**06**
	b	Explain various approaches of adding texture on surfaces in detail.	**06**

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