Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 710202N

Subject Name: Advanced Computer Graphics

Date: 01 /02 /2011 **Time: 02.30 pm – 05.00 pm**

Total Marks: 70

Instructions:

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

Q.1 **(a)** Define axonometric projection. Derive the transformation matrix for trimetric projection. **07**

(b) Consider a unit cube whose opposite diagonal corners are placed at (0, 0, 0) and (1, 1, 1). The cube is rotated about y-axis by $\phi = -45°$, about x-axis by $\theta = 30°$, and then projected on to the z = 0 plane from the center of projection at $z = z_c = 2$. Find the composite perspective transformation matrix. Also find the principle vanishing points along all three principle axis. **07**

Q.2 **(a)** Explain the effects of multiple knots and multiple control points for B-spline curves with necessary diagrams. **07**

(b) Derive the equation for Hermite curve. Also find the condition for C_1 and C_2 continuity between two Hermite curves. **07**

OR

(b) Derive the equation for Hermite surface. Find condition for C_1 continuity between two Hermite surfaces. Also find the normal to the surface. **07**

Q.3 **(a)** Explain the regularized Boolean set operations in brief. How they are different from standard Boolean set operations? **07**

(b) Enlist different spatial partitioning representation methods. Describe Octree in brief. **07**

OR

Q.3 **(a)** Explain the followings:

(i) Constructive solid geometry **03**

(ii) Binary space partitioning tree **04**

(b) Explain different color models used in computer graphics in brief. Also mention the applications of each color model. **07**

Q.4 **(a)** Briefly explain depth-sort algorithm to determine visible surface. How ambiguities are resolved in the algorithm? **07**

(b) Which data structures are required in scan line visible surface determination algorithm? With example explain how does visible span is determined in the algorithm? **07**

OR

Q.4 **(a)** Briefly explain Warnock's algorithm to determine visible surface. How it is determined whether polygon is completely inside the area of interest or it is disjoint? **07**

(b) Consider the triangle with coordinates A(1,2,1), B(6,2,1) and C(4,4,1). Point P in the triangle has coordinates (3, 3, 1). Apply Phong illumination and find out the intensity at point p if point light source direction L = i + k, viewing direction V = i + j + k, fatt = 1, Ks = 0.8, Ia = 1, Ip = 10, Kd = Ka = 0.15 and n = 2. Which method you used to shade entire triangle? **07**

Q.5 **(a)** Briefly explain local and global illumination. With equation and diagram explain recursive ray tracing method. **07**

(b) Briefly explain Gamma correction. Why it is required? Briefly explain various methods to increase intensity levels in black and white monitor? **07**

OR

Q.5 **(a)** Briefly explains various approaches of adding texture on surfaces. Find a mapping function that map a rectangular image of dimension 100 X100 on to a spherical surface patch of radius r units given by **07**

$X = 160 - 50 \cos\Phi \sin\theta$

$Y = 100 + 50 \sin\Phi$

$Z = 100 + 50 \cos\Phi \sin\theta$

where $0 \le \theta \le \pi/2$ and $-\pi/4 \le \Phi \le \pi/4$.

(b) Briefly explain character animation and facial animation. **07**

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