Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject code: 710204N

Subject Name: Computer Graphics

Date: 04 /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)** Develop an algorithm for scan converting unfilled rounded rectangles with a specified radius for the quarter-circle corners. **07**

(b) Describe the methodology for filling polygons. Take an example of a polygon (with number of edges >= 5), and draw bucket-sorted edge table for that polygon. Also show at least two examples of active-edge table of polygon. **07**

Q.2 **(a)** Write the basic steps required in extended mid-point algorithm for scan-converting ellipses to handle filled ellipses using span table. **07**

(b) Consider a convex polygon with n vertices being clipped against a clip rectangle. What is the maximum number of vertices in the resulting clipped polygon? What is the minimum number? Consider the same problem for a concave polygon. How many polygons might result? If a single polygon results, what is the largest number of vertices it might have? **07**

OR

(b) Describe the basic steps required for line-clipping using Cohen-Sutherland algorithm using region outcodes. Take various scenarios (examples) of lines intersecting different regions; and describe the sequence of clipping to be carried out for each case as per this algorithm. **07**

Q.3 **(a)** Explain aliasing and anti-aliasing techniques. Describe un-weighted area sampling for anti-aliasing. What are its drawbacks? How are these drawbacks tackled through weighted area sampling? **07**

(b) Consider a line from the origin of a right-handed coordinate system to the point (x, y, z). Find the transformation matrices needed to rotate the line into the positive z-axis in three different ways, and show by algebraic manipulation that, in each case, the P does go to the z axis. For each method, calculate the sines and cosines of the angles of rotation. **07**

i. Rotate about the x axis into the (x, y) plane, then rotate about y axis into the z axis.

ii. Rotate about the y axis into the (y, z) plane, then rotate about x axis into the z axis.

iii. Rotate about the z axis into the (x, z) plane, then rotate about y axis into the z axis.

OR

Q.3 **(a)** Describe (i) Perspective projections, and (ii) Parallel Projections **07**

(b) Given a unit cube with one corner at (0, 0, 0) and the opposite corner at (1, 1, 1), derive the transformations necessary to rotate the cube by θ degrees about the main diagonal (from (0, 0, 0) to (1, 1, 1)) in the counter-clockwise direction when lookin along the diagonal toward the origin. **07**

Q.4	**(a)**	How long would it take to load a 512x512 by 1 bitmap, assuming that the pixels are packed 8 to a byte and that bytes can be transferred and unpacked at the rate of 100,000 bytes per second? How long would it take to load a 1024x1280 by 1 bitmap?	**07**
	(b)	Describe Uniform Non-rational B-Splines.	**07**
		OR	
Q.4	**(a)**	Write a note on raster-scan display systems.	**07**
	(b)	Describe Hermite Curves.	**07**
Q.5	**(a)**	Describe rendering techniques for line drawings.	**05**
	(b)	Write a note on Coherence.	**05**
	(c)	Describe Back-face Culling.	**04**
		OR	
Q.5	**(a)**	Describe rendering techniques for shaded images.	**05**
	(b)	Write a note on Perspective Transformation.	**05**
	(c)	Describe Spatial Partitioning.	**04**

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