

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019**COMPUTER GRAPHICS**

(Computer Science & Engineering)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. Answer **ALL** the question in **Part-A**
 3. Answer any **FOUR** Questions from **Part-B**

PART -A

1. a) Explain text clipping. (3M)
- b) Calculate the clipping window height for the perspective-projection frustrum. (3M)
- c) Show the steps in morphing a line into two lines with included angle. (2M)
- d) Explain Frame mapping. (2M)
- e) Explain Julia sets. (2M)
- f) How do you reduce Ray-surface intersection calculations? (2M)

PART -B

2. a) Derive the concatenated transformation matrix to zoom a square about its center. (7M)
- b) Use the midpoint method and symmetry considerations to scan convert the parabola $x = y^2$ for the interval x varying between (-10 to 10) (7M)
3. a) Consider the defining polygon $B_1[1 \ 1]$, $B_2[2 \ 3]$, $B_3[4 \ 3]$, $B_4[3 \ 1]$ of the open B-spline curve. Determine the first derivative of the second order curve? (7M)
- b) Derive the resultant transformation matrix to rotate a given point about an arbitrary axis (7M)
4. a) Write a program/algorithm to implement the simulation of a bouncing ball. (7M)
- b) Write an OpenGL program to display a set of diagonal lines using any one-dimensional texture pattern. (7M)
5. Write a complete OpenGL program to display a set of diagonal lines using various one dimensional texture patterns. (14M)
6. a) Using the random mid-point displacement method, write a routine to create a mountain outline, starting with a horizontal line in the xy-plane. (10M)
- b) Explain self similarity of fractals. (4M)
7. a) Derive Ray-sphere intersection mathematics. (7M)
- b) Explain with an example how to reduce object-intersection calculations using ray-tracing. (7M)

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PART - A

1. a) Supply the two dimensional viewing transformation matrix and interpret the same. (2M)
- b) Obtain the oblique parallel projection coordinates of point (x,y,z). (3M)
- c) Explain YIQ color model. (3M)
- d) Contrast between the texture and bump mappings. (2M)
- e) Write a note on Peano curves. (2M)
- f) Obtain the unit transmission vector **T** in the refraction direction. (2M)

PART - B

2. a) Devise a parallel method for implementing a line-style function. (7M)
- b) Use the glutSetColor function to setup a color table for an input set of color values. (7M)
3. a) Develop a routine to reflect a 3-D object about an arbitrarily selected plane. (7M)
- b) Develop an algorithm for calculating the normal vector to a B-spline surface at a given point P(u,v). (7M)
4. a) Write a morphing program to transform a sphere into a specified octahedron. (7M)
- b) Explain OpenGL three dimensional viewing functions. (7M)
5. Write an OpenGL program to display a scene containing a sphere and a tetrahedron illuminated by two light sources: one is to be a local red source and the other a distant white light source. Set surface parameters for both diffuse and specular reflections with Gouraud shading surface rendering, and display a quadratic intensity-attenuation function. (14M)
6. a) Write a program to display the fractal snowflake (Koch curve) for a given number of iterations. (10M)
- b) Explain Mandelbrot sets. (4M)
7. a) Compute the ray-sphere intersection equation using the quadratic formula, and show how it can be simplified to determine only whether or not the ray and sphere intersect. (10M)
- b) Explain Boolean operations on objects through an example. It should involve atleast 4 operations. (4M)

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PART -A

1. a) Why do you take unit steps along x-axis in Bresenham's line generation algorithm? (2M)
- b) Supply and explain general perspective transformation matrix. (3M)
- c) Draw the RGB color model cube and explain how shades of Gray are represented. (3M)
- d) Explain adding shadows of objects. (2M)
- e) What is fractal dimension? (2M)
- f) What is the mapping from texture space to object space? (2M)

PART -B

2. a) OpenGL antialiasing functions and Query functions. (7M)
- b) Derive the ellipse drawing algorithm. (7M)
3. a) Derive the composite transformation matrix to align an arbitrary vector in 3-D space with the Z-axis (7M)
- b) Derive the blending functions for a a two dimensional, uniform, periodic B-spline curve of degree of degree 3 assuming the number of control points to be 5. (7M)
4. Devise an algorithm for generating solid objects as combination of 3-D primitives using Constructive solid geometry scheme. (14M)
5. Setup an algorithm , based on one of the visible-surface detection methods, that will identify shadow areas in a scene illuminated by a distant point source. (14M)
6. a) Explain how to control Terrain topography. (10M)
- b) Write a program to display the fractal snowflake(Koch curve) for a given number of iterations. (4M)
7. a) Derive Ray-polyhedron intersection mathematics. (10M)
- b) Discuss distributed ray tracing. (4M)

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**PART -A**

1. a) Supply Open GL attribute groups. (2M)
- b) Explain B-Spline basis. (3M)
- c) Provide the basic equations of XYZ color model. (3M)
- d) Explain creating shaded objects. (2M)
- e) What are Mandelbrot's sets- explain? (2M)
- f) Explain two Boolean operations on objects. (2M)

**PART -B**

2. a) Derive the necessary mathematics for transformation between two-dimensional coordinate systems. (7M)
- b) Supply the OpenGL raster transformation functions. (7M)
3. a) Provide GLU quadric surface functions. (7M)
- b) Explain GLU-surface trimming functions with an example. (7M)
4. a) Write a morphing program to transform a sphere into a specified hexahedron. (7M)
- b) Explain sweep and octree schemes of solid modeling. (7M)
5. Write a program using a two dimensional OpenGL texture pattern to display a white rectangle with a set of evenly spaced diagonal red strips. Set the background color to blue. (14M)
6. a) Derive the necessary mathematics of self-squarring fractals. (10M)
- b) Discuss shape grammar and other procedural methods. (4M)
7. a) Show how can you estimate an object's volume using ray-tracing algorithm. (10M)
- b) Discuss antialiased Ray tracing. (4M)