TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEI	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Computer Graphics (*EX 554*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What is refresh rate? Calculate the size of frame buffer in KB needed to represent the screen of size 4 inch × 5 inch whose resolution is 128 dpi and uses the 8-bit true color. [4]
2. Devise Bresenham's decision parameter for a straight line with negative slope with $|m| < 1$, applying right to left sampling. Assume that the line lies in the second quadrant. [10]
3. Derive the transformation matrix to reflect the object from line $y = mx + c$. [5]
4. Define window to view port transformation. Clip the line RS, R (2, 4) and S (8, 7) against the window WXYZ, W(3, 3), X(3, 6), Y(7, 6), and Z(7, 3) using Cohen Sutherland algorithms. [5]
5. Describe 3-D viewing pipeline. Obtain the perspective projection matrix for the projection reference point lies on the negative Z-axis. [5+5]
6. What is the importance of parametric cubic curve in graphical modeling? Derive the relation of blending function of Hermite curve using interpolation. [5]
7. Given a Bezier curve with 4 control points A(1, 0), B(3, 3), C(6, 3), D(8, 1). Determine any 5 points lying on the curve. Also draw a rough sketch of the curve. [5]
8. Compare object space method and image space method. Describe the back face detection method with necessary figures and apply this algorithm to find the visibility of a triangular object defined by coordinates (2, 0, 0), (0, 2, 0), (0, 0, 2) when viewed from point (4, 4, 4). [2+4+4]
9. Classify the different types of visible surface detection techniques. Explain about back face detection method for visible surface detection. [5]
10. List the disadvantage of depth buffer method. Explain how scan line method detects the visible surface with example. [5]
11. Write a general illumination model with multiple light sources and explain each term with necessary figures. What is the attenuation factor and how does it affect the intensity calculation? [6]
12. Briefly explain Gouraud shading and Phong shading algorithms with necessary derivations and figures and compare these algorithms. [6]
13. Define callback function. Demonstrate how a polygon can be created using OpenGL. [4]

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1. What is pixel and pixel depth? Let the resolution of screen is 1024 × 512. What is the memory captured by the frame buffer that uses primary color for display? [2+3]
2. Derive the p-value for midpoint circle algorithms scanning towards anti clockwise direction starting from (r,0). [7]
3. Compare and contrast between Digital Differential Analyzer line drawing algorithm and Bresenham's Line drawing algorithm. [3]
4. Scale the triangle with vertices A (1,1), B (4,4) and C (2,3) to double along horizontal direction and triple of vertical direction about point (2,3). [6]
5. Use Cohen Sutherland clipping Method to clip a line starting from A (-1,5) and ending at B(3,8) against the window having its lower corner at (-3,1) and upper right corner at (2,6). [4]
6. Why we need projection in computer graphics? How can you reflect an object about an arbitrary axis in 3D? Explain each step in detail. [8]
7. Define Hermite curve. Write the equation of Bezier curve with four control points p_1 (2,2,0), p_2 (2,3,0), p_3 (3,3,0), and p_4 (3,2,0). Find the coordinate pixel of the curve for u = 0, 1/4, 1/2, 3/4 and also plot the curve on graph. [8]
8. Differentiate boundary representation and space partitioning representation of polygon surface. If three vertices of a polygon surfaces in anticlockwise direction are V1 (1,0,0), V2 (1,1,0) and V3 (1,0,1). Calculate normal vector of that surface. [4+4]
9. How Scan Line Method is used for visible surface Detection? Explain in detail. [8]
10. Define Illumination and surface rendering. Explain basic illumination model. [2+6]
11. Explain Gouraud shading method with its advantages and disadvantages. [8]
12. Explain the importance of open GL. Write a program to display Red Rectangle in open GL. [7]

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1. Consider 256 × 256 image with 24-bit true color. If 10 minutes video is capture with frame rate of 50fps calculate the total memory required? [4]
2. Derive the decision parameters for mid-point ellipse drawing algorithm with necessary figures. [10]
3. Why we need clipping operation in graphics? Clip a line having end coordinates (4,12) and (8,8) against a rectangular window having left bottom corner at (5,5) and right top corner at (9,9) using liang barskys algorithm. [2+6]
4. Perform rotation of a triangular with vertices (100,100,100), (200,200,150) and (150, 150, 300) about Y-axis with 45 degree in clockwise direction. Show each step involved. [3+7]
5. Find the equation of the Bezier curve with given four 2D control points (0,0), (8,10), (15,-8), (20,0) and calculate the coordinate point at u=0.6. [5+3]
6. Differentiate object space method and image space method. Explain depth buffer method with necessary figures and show the depth calculation steps. What is its drawback? [10]
7. What are the guidelines to generate error free table? How the geometric informations of 3-D objects are stored for the object representation? Explain with examples. [2+6]
8. Derive the expression to calculate the intensity of Specular reflection in the presence of Point light source. Also write the expression for multiple light sources. How do you consider the distance to calculate the intensity for Specular Reflection? [6+2+2]
9. What are the disadvantages of flat shading model? Which method do you prefer to overcome this disadvantages? Explain. [8]
10. Explain the importance of OpenGL in computer graphics. [4]

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