TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam	**New Back (2066 & Later Batch)**		
Level	BE	**Full Marks**	80
Programme	BCT, BEX	**Pass Marks**	32
Year/Part	III/I	**Time**	3 hrs.

Subject: - Computer Graphics*(EX603)*

- ✓ *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. Differentiate between vector and raster systems. [4]
2. Derive and write midpoint algorithm for drawing a circle. [5+5]
3. What are the different steps of two dimensional world to screen viewing transformations? Describe with matrix representation at each steps. [5]
4. Obtain the end points of the line connects P1(0, 120) and P2(130, 5) after cohen sutherland clipping. The clip window has the following parameters. [5]
   Xwimn=0,, Ywmin=0, Xwmax=150 and Ywmax=100
5. Describe three dimensional viewing pipelining. Derive the transformation matrix for parallel projection. [4+6]
6. Explain about parametric cubic curve? What is a Bezier Curve? Explain its properties with examples. [2+6]
7. Explain boundary representation technique to represent three dimensional objects with suitable examples. [8]
8. Compare object space method with image space method. Explain, How Back-face detection method is used to detect visible surface. Also explain z-Buffer method.[2+4+4]
9. Define and explain the term ambient light, diffuse reflection and specular reflection with appropriate mathematical expressions. [7]
10. Explain the method of Phong shading for polygon rendering. [7]
11. Explain about Open GL and call back functions. [6]

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2072 Chaitra

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12. What are the differences between random and raster display technologies? [4]
13. How do you apply symmetry concept while drawing circle? Calculate the point in the circumferences of the circle having radius 8 unit and center at (-5, 10) using midpoint circle algorithm. [2+8]
14. What are the conditions for a point clipping ? Find the clipped region of the line with endpoints (5, 130) and (50, 5) in a rectangular window with (10, 10) and (100, 100) diagonal vertices using Cohen-Sutherland line clipping algorithm. [10]
15. What is 3D shearing? Write its matrix representation. A unit length cube with diagonal passing through (0, 0, 0) and (1, 1, 1) is sheared with respect to yz place with the shear constants=2 in both directions. Obtain the coordinates of all the corners of the cube after shearing. [2+8]
16. Explain about parametric cubic curves. What do you mean by Bezier Curve? Explain the properties of Bezier curves. [2+2+4]
17. Explain how the geometric and attribute information of a three dimensional objects are stored for the object representation? What are the conditions for free generation of polygon table? [4+4]
18. Outline the Z buffer algorithm. List the advantages and disadvantages of the z-buffer algorithm. [6+2+2]
19. Explain about different types of lighting sources and how these light sources affect the illumination model? Explain about the intensity interpolation surface rendering technique by highlighting its pro and cons. Also give example about Phong illuminations model. [3+5+6]
20. Why GLUT is implemented in OpenGL? What are the applications of OpenGL? [2+4]

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1. Derive the Bresenham's decision parameter to draw a line moving from left to right and having negative slope. State the condition to identify you are in the second region of the ellipse using mid point algorithm. [8+2]
2. Write down the condition for point clipping. Find the clipped region in window of diagonal vertex (10, 10) and (100, 100) for line P_1(5, 120) and p_2(80, 7) using Liang-Barsky line clipping method. [2+8]
3. Find the transformation matrix the transforms that rectangle ABCD whose center is at (4, 2) is reduced to half of its size, the center will remain same. The co-ordinate of ABCD are A(0, 0), B(0, 4), C(8, 4) and D(8, 0). Find co-ordinate of new square. Also derive the transformation matrix to convert this rectangle to square. [10]
4. List out the properties of Bezier curve. What is order of continuity ? Explain. [8]
5. Explain the significance of spatial orientation of a surface and polygon tables. Explain with example. [8]
6. Compare Z-buffer and A-buffer Algorithm . Also write algorithm to find visible surface. [10]
7. Explain the general illumination model. How this model is used for rendering by using gouroud shading. [7+7]
8. Write short notes on. [5+5]
   a. Raster scan display
   b. Open GL

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Year/Part	III/I	**Time**	3 hrs.

Subject: - Computer Graphics*(EX603)*

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1. Differentiate Random and Raster display technology. [4]
2. Compare between DDA and Bresenham's line drawing algorithm. Derive and write mid-point algorithm to draw ellipse. [10]
3. The reflection along the line y=x is equivalent to the reflection along the X-axis followed by counter clock wise rotation by α (alpha) degree. Find the angle α. [2+8]
4. Write rotation matrix in clockwise direction with respect to x-axis, y-axis and z-axis. Rotate the object (0, 0, 0), (2, 3, 0), (5, 0, 4) about the rotation axis y=4. [10]
5. Write down properties of Bezier curve. Find equation of Bezier curve whose control points are P0(2, 6), P1(6, 8) and P2(9, 12). Also find co-ordinate of point at u=0.8.[10]
6. Explain boundary representation technique to represent the 3D object with suitable example. How can you find the spatial orientation of a surface? [8+2]
7. Explain z-buffer algorithm along with necessary steps needed to calculate the depth. What is its drawback? [10]
8. Define the terms:
   I. Ambient light
   II. Lambert cosine law
   III. Diffuse reflection
   IV. Specular reflection
   Also find equation for intensity of point by using phong illumination model.
9. What is openGL? Explain callback function. [4+2]

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1. Consider a raster scan system having 12 inch by 10 inch screen with a resolution of 100 pixels per inch in each direction. If the display controller of this system refreshes the screen at the rate of 50 frames per second, how many pixels could be accessed per second and what is the access time per pixel of the system ? [4]
2. What is scan conversion ? Derive the Bresenham's decision parameter to draw a line with negative slope and /m/>1 [2+8]
3. Given a clipping window A(10, 10), B(40,10), C(40, 40) and D(10, 40). Using Cohen-Sutherland line clipping algorithm find region code of each end points of lines p_1, p_2, p_3p_4 and p_5p_6 where co-ordinates are p_1(5,15), p_2(25, 30), p_3(15, 15), p_4(35, 30), p_5(5, 8) and p_6(40, 15). Also find clippies lines using above parameters. [10]
4. Perform rotation of a line (10, 10, 10), (20,20,15) about Y-axis in clock wise direction by 90 degree. Explain about vector display. [6+4]
5. Derive the equation for cubic Bezier curve, also write down its properties. [8]
6. Explain how the 3D object is represented using polygon table representation technique ?

   Explain any one technique to calculate the spatial orientation of the individual surface component of 3D object. [4+4]
7. Describe scan line method to find visible lines with example. [10]
8. Under what condition (s) flat shading gives accurate rendering ? Mention the disadvantage if intensity interpolation technique and explain phong shading with necessary mathematical calculation. Explain the diffuse reflection. [3+1+6+4]
9. Why GLUT is implemented in OpenGL? Explain OpenGL syntax to draw a parallelogram having verticals(0.0, 0.0), (1.0, 0.0),(1.5, 1.2) and (0.5, 1.2). [2+4]

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Year/Part	III/I	**Time**	3 hrs.

Subject: - Computer Graphics*(EX603)*

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1. How much time is spent scanning across each raw of pixels during screen refresh on a raster system with resolution 1024*768 and refresh rate 60 frames per second? [4]
2. Mention the disadvantages of DDA method. Write the complete Bresenham's line drawing algorithm and using midpoint circle drawing algorithm calculate the co-ordinate on the first quadrant of a circle having radius 6 and centre(20, 10). [2+4+4]
3. State the conditions of point clipping. Perform clipping operation for the following using Liang Barsky line clipping algorithm:
   Clipping window: (Xmin, Ymin)= (2, 5) and (Xmin, Ymin)= (35,50)
   Line: (x1, y1)=(-2, 2) and (x2, y2)= (45,40)
4. Define window and view port. Describe three dimension windows to view port transformation with matrix representation for each step. Derive oblique projection matrix with necessary assumptions. [1+4+5]
5. Define Hermite Interpolation in defining a curve. Use it to find the blending function of parametric cubic curve in 2D graphics. [2+6]
6. Describe polygon, Vertex and Edge table of polygon. How these terms are important in computer graphics. [8]
7. Describe z-buffer method for visible surface detection in detail. State its limitation and recommended method that address it. [7+3]
8. Calculate the total intensity using phone secular reflection model by considering all type of light sources. [8]
9. Compare and Contract between Gouraud and Phong Shading Model. [8]
10. Write short notes on:
    a) call back function
    b) OpenGL

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1. If we want to resize at 1024 * 768 image to one that is 640 pixels wide with the same aspect ratio, what would be the height of the resized image? [4]
2. What is the advantage of Bresenham's algorithm over DDA algorithm for line drawing? Use Bresenham's algorithm to scan convert a straight line connecting the end points (20, 10) and (30, 18). [3+7]
3. Derive the 2D transformation matrix for rotating an object by angle θ about a pivot point (Xr, Yr). [8]
4. Obtain perspective projection co-ordinates for the pyramid with vertices of base (15, 15, 10), (20, 20, 10), (25, 15, 10), (20, 10, 10) and apex (20, 15, 20): given that Zprp=20 and Zvp=0. [8]
5. What is the difference between an interpolation spline and an approximate spline curve? Explain how to satisfy C^0 and C^1 continuity conditions when joining two Bezier curve sections together. [2+6]
6. Describe with illustrate how polygon tables may be used to organize geometric data for polygon surfaces boundary representation. [8]
7. how can you calculate depth of pixels and how it can be used to detect visible surface in depth buffer method? Explain. [8]
8. Derive the total diffuse reflection equation, including ambient light. [8]
9. Explain the Phong Shading model for polygon- rendering. [6]
10. Explain OpenGL with suitable examples. [6]
11. Write short notes on: [3*2]

    a) 2D translation

    b) Application of 3D transformation

    c) Difference of image space and object space techniques.

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Subject: - Computer Graphics*(EX603)*

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1. Derive decision parameters for midpoint circle algorithm assuming the start position as (r, 0) and points are to be generated along the curve path in counter clock wise order. What is symmetry property? [8+2]
2. Explain the two dimensional viewing pipeline. Derive the 2D transformation matrix for scaling with respect to an arbitrary fixed point. [4+6]
3. How can you perform three dimensional rotations of an object about some arbitrary axis? Explain. [8]
4. What is Geometric table? Construct a Geometric table for considering an object having 3 surfaces formed from 6 vertices and 8 edges. [2+6]
5. How can you model a curved surface using polygons only? Explain the use of polygon tables for boundary representations. [3+5]
6. What is the difference between object space method and image space method for visible surface determination? Explain the Z-buffer method for visible surface determination. [3+7]
7. Explain the Phong illumination model for specular reflection. [7]
8. Explain the Gouraud Shading intensity- interpolation scheme for polygon-rendering. [7]
9. Why open GL required? Explain with examples. [6]
10. Write short notes on: [2 *3]

    a) Applications of computer graphics

    b) Two-point perspective projection

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Year/Part	III/I	**Time**	3 hrs.

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11. What is the size of frame buffer required to store a SVGA with 24 bit true color video of 10 min without compression? [4]
12. Digitize the endpoint (10, 18), (15, 8) using Bresenham's algorithm. [8]
13. Find the composite transformation matrix for reflection about a line y=m*x+c. [8]
14. Find the new coordinates of a unit cube 90^0-rotated about an axis defined by its endpoints A(2, 1, 0) and B(3, 3, 1). [8]
15. Why 3D graphics is more complex than 2D graphics? Explain with the help of viewing pipeline. [8]
16. Explain about parametric cubic curve? What is Bezier Curve? Explain its properties. [3+3+2]
17. Explain how the geometric cubic and attribute information of a three dimensional objects are stored for the object representation? What are the conditions for free generation of polygon. [5+3]
18. Differentiate between image space and object space methods of visible surface detection. Describe A-Buffer method of visible surface detection. [4+6]
19. Explain the Gourad shading for polygon-rendering and compare it with Phong shading. [8+2]
20. Write short notes on: (any two) [4*2]

    a) Specular Reflection

    b) Midpoint circle decision parameter

    c) Application of OpenGL in Computer Graphics