TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / 1	Time	3 hrs.

Subject: - Computer Graphics *(EX 603)*

- ✓ 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 raster scan and random scan display. If we want to resize at 1920×1080 image to one that is 1280 wide with the same aspect ratio, what would be the height of resized image? [4]
2. Derive the P-value for Breshenham's line drawing Algorithm for $m < 0$ and $|m| > 1$. [6]
3. Using midpoint circle algorithms, calculate the co-ordinates to plot on first and second quadrant of a circle with center (6,7) and radius = 9. [5]
4. Prove that two successive rotation operations are additive in composite transformation. Find the clipped region in the window of diagonal vertex (10,10) and (100,100) for line P1 (5,120) and P2 (80,7) using Liang –Barsky Line Clipping Algorithms. [7]
5. What is the importance of window to view port transformation in computer Graphics? Explain two-dimensional viewing pipeline. [4]
6. Derive the matrix for ortho-graphic projection. The pyramid defined by coordinates A (0,0,0), B (1,0,0), C (0,1,0) and D (0,0,1) is rotated by 45° about the line L that has direction $\vec{V} = \vec{J} + \vec{K}$. Passing through point C (0,1,0). Find the final co-ordinates of pyramid after transformation. [2+8]
7. List the properties of the B-spline curve. Derive Hermite matrix in Hermite Cubic Spline Curve. Find the coordinates at U = 0.3 with respect to the control points (10,12), (15,28),(22,35) and (28,9) using Bezier function. [2+8]
8. Explain the importance of polygon table, plane equation and polygon mesh in surface modeling. [3+3]
9. How much memory is requires to implement z-buffer algorithms for a 512×512×24 bit-plane image? Explain how z-buffer algorithms determine the visibility of polygon surface along with necessary derivations algorithms limitation. [2+8]
10. What do you mean by illumination model? Explain about specular reflection with appropriate mathematical expression. [2+5]
11. What are the different methods available for shading? Which one is more realistic and why? Explain with necessary derivation and algorithms. [1+6]
12. Discuss the need of OpenGL. Explain callback function. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Computer Graphics *(EX 603)*

- ✓ 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. How does a raster display system generate images on a screen? If the total number of intensities achievable out of a single pixel on the screen is 1024 and total resolution is 1024×800, what is will be the required size of frame buffer incase of display purpose? [2+2]
2. Derive a decision parameter for midpoint circle algorithm assuming the start position as (+r, 0) and points are to be generated along the curve path in clockwise direction. [6]
3. Digitize the given line end points (10, 10) and (20, 5) using Bresenham's line drawing Algorithms. [4]
4. Clip the line with end point A (5, 30), B(20, 60) Against a clip window with lower most corner at P (10, 10) and upper right most corner at R (100, 100) using cohen sulter land line clipping algorithms. [4]
5. Derive the two dimensional reflection matrix through the line y = x+1. What are the finial co-ordinates of objects (2, 3) (4, 3),(4, 5) about line y = x+1? [6]
6. Derive the single 3D transformation matrix for reflection through the plane containing points with co-ordinates (5, 0, 0) and (0, 0, 5) and being parallel to the y-axis. Given 3D triangle with end points (0, 0, 0), (1, 1, 2) and (1, 1, 3) is subjected to shearing with parameter 2 on x-axis and 2 on y-axis, 3 on z-axis and find out new co-ordinates of object? [6+4]
7. Construct the Bezier curver of order 3 and with polygon vertices A (1, 1), B(2, 3), C(4, 3) and D(6, 4) at u =0, 0.25, 0.5, 0.75, 1. Derive the blending function for parametric cubic curve. [4+6]
8. How do surface modeling techniques contribute to realistic rendering and visualization in computer graphics? Explain about blobby object representation. [8]
9. Differentiate between Image space and object space method. How is back face detection method used for visible surface detection? Explain in detail. How A buffer method eliminate the drawbacks of Z buffer method? [2+5+3]
10. What is attenuation factor and Mach Band effect? Discuss the effect of Mach Band in Phong, Gourand and constant Shading. [2+2+3]
11. Define and explain the term ambient light, diffuse reflection and specular reflection with appropriate mathematical expressions. [2+2+3]
12. Mention any three-color command in OpenGL. How lighting is applied to the surface of polygon in OpenGL? [2+2]

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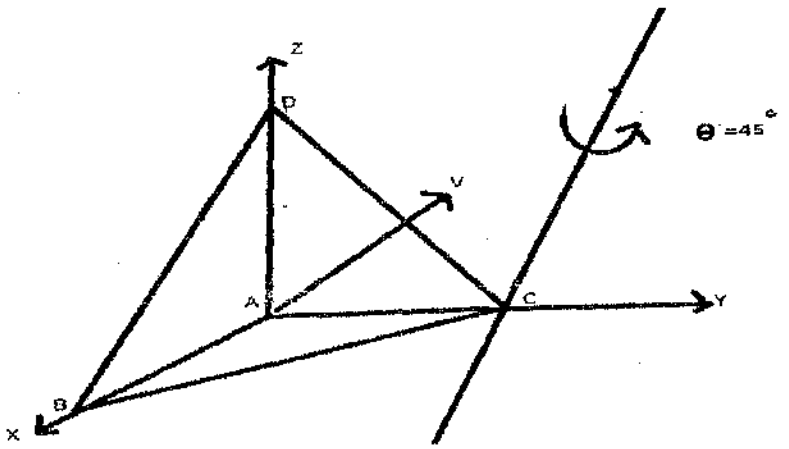
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT,BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Computer Graphics *(Ex 603)*

- ✓ 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. Define the terms pixel, resolution and pixel density. How much time is spent scanning each row of pixels during screen refresh on a raster system with resolution of 640×480 whose refresh is 24 frames per second? Also calculate the access time per pixel. [3+3]
2. Derive an expression for drawing on ellipse. [10]
3. Explain 2-D viewing pipeline. Obtain window to viewport transformation matrix with necessary steps and figures. Give example. [3+4+3]
4. The pyramid defined by the coordinate A(0,0,0),B(1,0,0),C(0,1,0) and D(0,0,1) is rotated 45° about line L that has direction V = J + K and passing through the point C(0,1,0).Find the coordinate of the rotated figure. [8]



5. What is Bezier Curve? Find the coordinates of Bezier curve at u = 0.25, 0.5 and 0.75 with respect to the control points (10,15), (15,25), (20,35), (25,15) using Bezier Function. [2+6]
6. How do you represent an object in 3D? Explain the steps to find surface normal vector of a surface represented by Ax +By +Cz + D = 0. [4+4]
7. What is the limitation of Z- buffer method? How does A-buffer method overcome it? Explain. [2+6]
8. What is illumination model ? How light intensity of a point can be calculated? Also, discuss about the type of light source in intensity calculation. [2+6]
9. What is Phong Shading Model? Write down the algorithm for this shading model. Can we use this method to reduce Mach-Band effect? [2+4+2]
10. Write the importance of OpenGL in computer graphics. Write OpenGL syntax to draw a rectangle and polygon considering your own vertices. [6]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Computer Graphics *(EX 603)*

- ✓ 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. Consider a raster system with a resolution of 1920 × 1080. How much storage is required if 24 bits per pixel are to be stored in a device with refresh rate of 50 Hz? Find out the aspect ratio. [4]
2. 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 (+8, 10) using midpoint circle algorithm. [2+6]
3. What do you mean by homogenous coordinates? By listing the steps involved, find out the final composite matrix for performing a rotation by 45 degrees about an arbitrary point (5, 5) in anti-clockwise direction. Use the obtained composite matrix to obtain the transformed coordinates of a triangle A(5, 6), B(6, 2) and C(4, 1). [1+5+2]
4. Explain about 3D viewing pipeline. How world-to-viewing coordinate transformation is performed? Describe with expression. [5+5]
5. Write the properties of Bezier curve. A cubic Bezier curve is described by the four control points. (0, 0), (3, 1), (5, 2) and (8, 1). Find the Bezier polynomial and the coordinate at f = 0.25, 0.5, 0.75. [3+8]
6. What is polygon table? List the rules for making error free polygon table. How do you calculate the spatial orientation of a polygon? [3+2+4]
7. Compare object space method and image space method. Explain depth buffer method in detail. Compare it with A-buffer method. [2+5+3]
8. Find out the total intensity at the centroid of a triangle defined by A(2, 1, 1), B(0, 1, 1), C(0, 0, 1), when illuminated by a point light source of intensity $I_L = 0.6$ at (3, 2, 8) using Phong Illumination model. The viewer is at (4, 3, 8). Assume ambient intensity Ia = 0.1 and parameters: ka = 0.5, kd = 0.8, ks = 0.7, take x = 5. [centroid: (x1 + x2 + x3)/3, (y1 +y2 y3)/3, (z1 + z2 +z3)/3]. Explain briefly different ways of shading this triangle. [8+6]
9. Why OpenGL is used? Write the basic command to draw the pixel rectangle and polygon in OpenGL. [2+4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Computer Graphics (*EX 603*)

- ✓ 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 are the differences between random and raster display technologies? When do we prefer them? [6]
2. Write an algorithm for Brescnham's method of line drawing. Digitize a line with end points (10, 20) and (15, 2) using this algorithm. [5+5]
3. Find the composite transformation matrix for reflection about a line y = mx +c. [8]
4. Describe polygon, Vertex and Edge table. How these terms can be used to construct a model of Dharahara. [2+2+2+2]
5. What do you underatand by affine transformation? Derive expressions for oblique projectiman paralle projection. [2+4+4]
6. What is a Bezier Curve? Find the coordinates of Benzier curve at u = 0.25, 0.5 and 0.75 with respect to the control points (10, 15), (15,20), (20, 35), (25, 10) using Bezier function. [1+5]
7. How back-face detectium method is used to detect visible surfaces? What are it's limitation? Purpose an approach to overcome it's limitations. [4+2+4]
8. Derive an expression for phong illumination model for light sources. [8]
9. Find out the total intensity at the centroid of a triangle defind by A(2,1,1), B(0,1,1), C(0,0,1), when illuminated by a point light source of intensity IL = 0.6 at (2,2,6) using illumination model. The viewer is at (2,3,6). Assume ambient Intensity Ia = 0.1 and parameters: ka = 0.5, kd = 0.8, ks = 0.7, take n = 10. [8]

   [centroid: (x1 + x2 +x3)/3, (y1+y2+y3)/3, (z1+z2+z3)/3]
10. What is open GL? How can we use lighting in open GL? [2+4]

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2078/07/12

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Computer Graphics *(EX 603)*

- ✓ 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 computer graphics? Calculate the total memory required to store a 10 minute video in a SVGA system with 24 bit true color and 60 fps refresh rate. [2+4]
2. Write an algorithm for drawing a circle. Using midpoint circle drawing algorithm, calculate the coordinates on the first quadrant of a circle having radius 8 and centre (10, 10). [4+6]
3. It is necessary to construct curves using parameteric equations? Justify. List down the steps for modeling curves using splines. [4+4]
4. Reflected the triangle ABC about the line 3X - 4Y + 8 = 0. The position vector of the coordinate ABC is given A(4, 1), B(5, 2) and C(4, 3). [8]
5. Describe 3D viewing pipeline. Derive complete world-to-viewing coordinate transformation matrix. [3+7]
6. Why do we use geometric tables and attribute tables for defining a polygon surface? How do you calculate the spatial orientation of a polygon? [3+3]
7. What is the limitation of Z-buffer method? How does A-buffer method overcome it, explain? [3+7]
8. Derive the expression to calculate the total light intensity in a point. [8]
9. Compare and contrast between Gouraud and Phong shading model. [8]
10. What is OpenGL? How can we draw colored line and polygon using OpenGL? [2+4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Computer Graphics *(EX 603)*

- ✓ 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. Distinguish between Raster and Vector graphics with suitable example. [6]
2. Digitize the endpoint (20, 10) and (30, 18) using Bresenham's algorithm. How the demerits of DDA is addressed in Bresenham's algorithm. [7+3]
3. Derive the composite matrix for rotation about arbitrary point (a, b) in clockwise direction with angle (θ). Write an algorithm for Cohen Sutherland line clipping algorithm. [6+4]
4. What are 3D Rotation and Shearing? Explain with matrix representations. A unit length cube with diagonal passing through (0, 0, 0) and (1, 1, 1) is sheared with respect to yz place with shear constants = 2 in both directions. Obtain the coordinates of all the corners of the cube after shearing. [3+7]
5. What is Parametric Cubic Curve and why do you need it? Write down the step for cubic spline interpolation. [3+5]
6. What is Wire-frame model and why do we need polygon data table? Explain with examples? [5]
7. Describe Z-Buffer method of visible surface detection. Compare this method to other methods of visible surface detection. [6+2]
8. What do understand by diffused and specular reflections and explain in detail how these terms are included in illumination model? [5+5]
9. Define the term illumination and rendering. Write down the steps for phong shading method. [2+6]
10. Write down the Open GL syntax to draw basic 2D geometric primitives with examples. [5]

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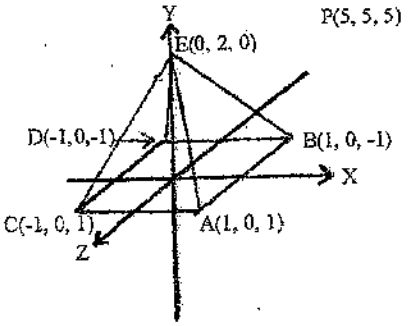
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Computer Graphics *(EX 603)*

- ✓ 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. Compare Raster-scan Display with Random-scan Display. [6]
2. Write the advantages of Bresenham's line drawing algorithm. Digitize the Ellipse with radius $R_x = 12$ and $R_y = 7$ and center (19, 10). [2+8]
3. Define window and view port. Describe about two-dimensional viewing pipeline with matrix representation at each steps. [2+8]
4. Derive an expression for Perspective projection of a 3D point. Also, 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 $z_{prp} = 20$ and $z_{vp} = 0$. [5+5]
5. Differentiate between Interpolation and approximation. Explain the process of performing curve modeling using splines. [3+5]
6. How can we model cone or cylindrical like surfaces using boundary representation and technique? [6]
7. Explain Back-face detection algorithm for visible surface detection. Find the visibility for the surface BED and ABCD where observer is at P(5, 5, 5). [3+5]



8. Define the term Surface rendering with Illumination model. Derive an expression to calculate the intensity of Diffuse reflection with necessary equations and figures. How do you consider the distance to calculate the intensity for Specular and Diffuse Reflection? [2+5+3]
9. What is Phong shading method? Can we use this method to reduce Mach-Band effect? [6+2]
10. What do you mean call back function? Illustrate with example. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

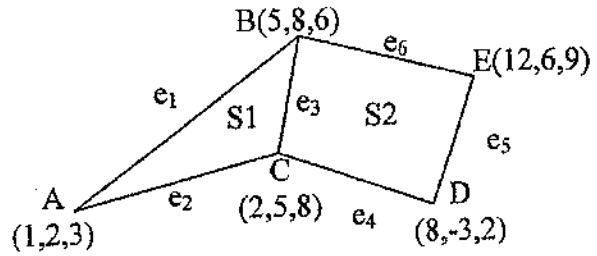
Subject: - Computer Graphics *(EX 603)*

- ✓ 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 raster and vector graphics. Calculate the frame buffer size (in KB) for a raster system recording a video for 1 min with resolution of 1280×1024, and storing 24 bits per pixel with a refresh rate of 25 fps. [2+4]
2. Explain the process of drawing ellipse in a raster graphics. Determine the pixel positions of following curve in first quadrant using mid-point algorithm. [4+6]

$$\frac{x^2}{64}+\frac{y^2}{36}=1$$

3. What do you mean by homogeneous coordinates? Rotate a triangle A(5,6), B(6,2) and C(4,1) by 45 degree about an arbitrary pivot point (3,3). [2+6]
4. List down the steps for rotating a 3D object by 90° in counter clockwise direction about an axis joining end points (1,2,3) and (10,20,30). Also derive the final transformation matrix. [10]
5. Mention two important properties of Bezier Curve and find the Bezier Curve which passes through (0,0,0) and (-2,1,1) and is controlled by (7,5,2) and (2,0,1). [2+6]
6. Represent the following surfaces by polygon table method and find the normal of surface S1. [2+5]



7. How hidden surfaces can be removed? Explain in detail about depth buffer methods. [8]
8. What is OpenGL? How pixels, lines and polygon is drawn and transformation is performed in OpenGL? [2+5]
9. List down different types of object and explain how Phong illumination model is used to calculate intensity in for these objects along with mathematical expression. [8]
10. Explain in detail about Phong shading. [8]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Computer Graphics *(EX 603)*

- ✓ 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. Define computer graphics. Illustrate about components for computer graphics. [2+4]
2. Differentiate between DDA and Bresenhamline drawing algorithm. Explain Bresenham line drawing algorithm and use this algorithm to draw a line with end points (25,20) and (15,10). [2+8]
3. Write matrix for 2D reflection about axes. Derive the transformation matrix responsible for the reflection of 2D object about line y+x=0. [2+6]
4. Explain with a block diagram about the 3D viewing pipeline. Along with the transformation matrix, describe how perspective projection is performed? [4+4]
5. Find the coordinates at U=0.25, 0.5, and 0.75 with respect to the control points (10,10), (15,25), (20,30), and (25,5) using Bezier function. Draw your curve with given control points. [8]
6. How can a 3D-Dimensional object be modelled? How a normal to a plane of this object is calculated? [3+3]
7. Explain backface detection algorithm. Determine whether two surfaces of a object with normals $2\vec{i}-3\vec{j}+4\vec{k}$ and $\vec{i}+\vec{j}-2\vec{k}$ respectively, viewed from a direction given by $\vec{i}-\vec{j}+\vec{k}$ are backface or frontface. [5+5]
8. How polygon is drawn in OpenGL? How lighting is applied to this polygon surface? [2+3]
9. 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? [8+4]
10. Write down an algorithm for intensity interpolation shading scheme. [7]

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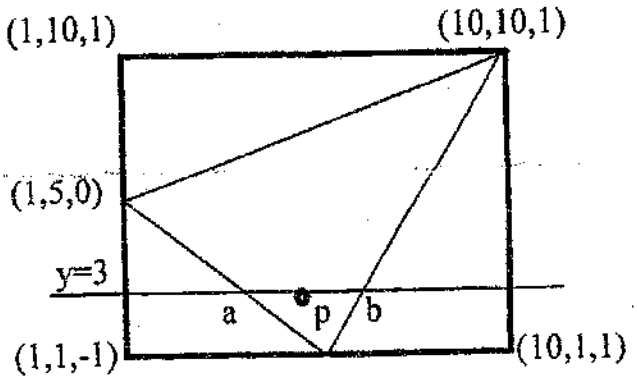
34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	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. Distinguish between Raster and Vector graphics methods. When do we prefer them? [6]
2. Digitize the line with end points A(20,10) and B(30,18) using Bresenham algorithm. [10]
3. Clip the line P1P2 with P1(-5,3) and P2(15,9) with clip window having diagonal coordinate (0,0) and (10,10) using Liang-Barskey line clipping method. [8]
4. Explain the steps required to rotate an object in 3D about a line which is not parallel to any one coordinate axis. [10]
5. How Geometric tables are used to represent a 3D object? Explain with example. Give conditions to generate error free table. [8]
6. Explain properties if Bezier curve. Find the coordinate at u = 0.2 with respect to the control points (1,1), (4,6) (8,-3) and (12,2) using Bezier function. [8]
7. Differentiate image space and object space method for visible surface determination. Explain scanline method to determine visible surface of object. [8+4]
8. 

   Find out intensity of light reflected from the midpoint P on scan line y = 3 in the above given figure using Gouraud shading model. Consider a single point light source located at positive infinity on Z-axis and assume vector to the eye as (1,1,1). Given d = 0, K = 1, $I_a = 1$, $I_L = 10$, Ks = 2, Ka = Kd=0.8 for use in a simple illumination model. [12]
9. What is OpenGL? Explain Callback Function. [4+2]

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34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	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. Calculate the size of frame buffer required to store a 640×480 B and W video of length 5 minutes without compression. [4]
2. Discuss the Digital Differential Analyzer (DDA) line drawing algorithm in detail. Also give its advantages and disadvantages. [8+4]
3. A triangle A (15, 20), B (20, 30) and C (30, 20) lies inside a window (10, 10), (40, 50). Find the final image of this triangle after transforming into the viewport (0, 0), (20, 20). Show all transformation steps. [8]
4. Briefly explain various projections? Find the new coordinates of a unit cube 90° rotated about an axis defined by its endpoints A (2,1,0) and B (3,3,1). [3+7]
5. Explain vertex, edge and surface table using a suitable example. What are the guidelines to generate error free table? [5+5]
6. Explain about parametric Cubic curve? What is Bezier curve? Explain its properties. [2+3+4]
7. Discuss back face removal algorithm? Describe its limitation. [8+2]
8. Compare Gouraud shading and phong's shading in detail. [9]
9. Why Open GL required? Explain call back function. [8]

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35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX, BCT	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 scan 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 transformation? Describe with matrix representation at each steps. [5]
4. Obtain the end points of the line that connects P1(0,120) and P2(130,5) after cohen-sutheland clipping. The clip window has the following parameters. [5]

   $x\omega_{min} = 0$, $y\omega_{min} = 0$, $x\omega_{max} = 150$ and $y\omega_{max} = 100$
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 example. [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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34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	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. What are the differences between random and raster display technologies? [4]
2. 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]
3. What are the conditions for a point clipping? Find the clipped region of the line with endpoins (5, 130) and (50, 5) in a rectangular window with (10, 10) and (100, 100) diagonal vertices using Cohen-Sutherland line clipping algorithm. [10]
4. 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]
5. Explain about parametric cubic curves. What do you mean by Bezier Curve? Explain the properties of Bezier curves. [2+2+4]
6. Explain how the geometric and attribute information of a three dimensional objects are stored for the object representation? What are the conditions for error free generation of polygon table? [4+4]
7. Outline the Z buffer algorithm. List the advantages and disadvantages of the z-buffer algorithm. [6+2+2]
8. 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]
9. Why GLUT is implemented in OpenGL? What are the applications of OpenGL? [2+4]

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8/7 Morning.

34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX, BCT	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. 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 Coordinate 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 surfaces using scan-line method. [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) OpenGL

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01/02

34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	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 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. [10]
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. [3+7]
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: [10]
   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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35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX, BCT	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. 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 (40,40), C(40,40) and D(10,40). Using cohen-sutherland line clipping algorithm find region code of each end points of lines P1P2, P3P4 and P5P6 where co-ordinates are P1 (5,15), P2(25,30), P3(15,15), P4(35,30), P5(5,8) and P6(40,15). Also find clipped 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 rending? Mention the disadvantage of 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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34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	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. How much time is spent scanning across each raw of pixels during screen refresh on a raster system with resolution 1024×768 and a refresh rate of 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 Barskey line clipping algotithm: [2+6]

   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 a 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 addresses 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: [3×2]
    a) Call back function
    b) Open GL

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35 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3hrs.

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. 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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