**Unit 1: Introduction to Computer Graphics (3 Hrs)**

* + **Generally Important Concepts:** While no questions directly target "Introduction to Computer Graphics" in a purely theoretical way across these papers, understanding the basics from this unit is crucial for grasping the entire subject. Concepts like Raster-Scan vs. Vector displays, Graphics Pipeline, and Application Areas underpin many other topics.

**Unit 2: Scan Conversion Algorithm (6 Hrs)**

* + **2080:**
    - **Question 1 (Section A):** What is a Digital Differential Analyzer (DDA)? How can you draw the line using this algorithm? Trace the points on the line path between A (1, 3) and B (6, 7) using Bresenham's line drawing algorithm.
  + **2079:**
    - **Question 1 (Section A):** Explain the working details of Mid-Point Circle Algorithm? Trace the points along the line path having two end points (6, 9) and (2,3) using Bresenham’s line drawing algorithm.
  + **2077:**
    - **Question 1 (Section A):** List the major differences between DDA and Bresenham's Line drawing algorithm. Illustrate the DDA algorithm to the line with end points (2, 2) and (9, 2).

**Unit 3: Two-Dimensional Geometric Transformations (5 Hrs)**

* + **2080:**
    - **Question 2 (Section A):** Differentiate between parallel and perspective projection with suitable diagram. Illustrate the window to viewport transformation with example. (While projections are also 3D, the window-viewport transformation is inherently 2D viewing)
    - **Question 5 (Section B):** Explain the importance of filling algorithms in the graphics applications. Differentiate between boundary and flood fill algorithm with algorithm. (Area filling is often discussed in the context of 2D graphics)
  + **2079:**
    - **Question 4 (Section B):** Reflect a line segment having endpoints (9,3) and (12,10) about a line Y = 7. Draw the initial and final result graph as well.
    - **Question 9 (Section B):** Find the composite transformation matrix for reflection about a line y = mx + c.
  + **2078:**
    - **Question 1 (Section A):** Define orthographic, parallel and perspective projections. Consider a region defined by the position vector relative to global XYZ axis system. It is rotated by +30° about X-axis and passing through point (1.5, 1.5, 1.5). Find the final position of the region. (While about projections in general, the transformation setup leans towards 2D concepts initially)
    - **Question 7 (Section B):** Find the new co – ordinate of the triangle ABC, with co-ordinates A(0, 0) , B(1, 1) and C(5, 2) after it has been magnified to twice of its size.
  + **2077:**
    - **Question 5 (Section B):** Translate a triangle ABC with co-ordinates A(0, 0), B(5, 0) and C(5, 5) by 2 units in x – direction and 3 units in y – direction.
    - **Question 6 (Section B):** Differentiate between orthographic, parallel and perspective projections. (Again, while projections are 3D, the differentiation often starts in the context of 2D viewing concepts)

**Unit 4: Three-Dimensional Geometric Transformation (5 Hrs)**

* + **2078:**
    - **Question 1 (Section A):** Define orthographic, parallel and perspective projections. Consider a region defined by the position vector relative to global XYZ axis system. It is rotated by +30° about X-axis and passing through point (1.5, 1.5, 1.5). Find the final position of the region. (This question, especially the rotation in 3D space, also strongly relates to 3D transformations).

**Unit 5: 3D Objects Representation (7 Hrs)**

* + **2080:**
    - **Question 6 (Section B):** What is virtual reality? Explain some form of virtual reality. (While VR is Unit 9, the question in this paper is more broadly about concepts, and could relate to 3D representation as VR deals with 3D environments.)
    - **Question 7 (Section B):** Reflect a line segment having end points (9,1) and (12,10) about a line X = 7. Draw initial and final result graph as well. (Reflection is a transformation but asked in a context that could lead to discussing 3D object manipulation).
    - **Question 8 (Section B):** Explain polygon surface representation using Polygon Table and Polygon Meshes.
  + **2079:**
    - **Question 6 (Section B):** Explain about parametric curve. Describe the properties of Bezier curve.
    - **Question 7 (Section B):** What are blobby objects? How it is represented? Explain the wireframe representation of 3D objects.
    - **Question 10 (Section B):** What is polygon table? Explain the use of this method in 3D object representation.
  + **2078:**
    - **Question 2 (Section A):** What is the method to recognize boundary point and interior point in solid modeling? Describe how BSP recursively subdivided a space into convex sets. (BSP is also a 3D representation method, and solid modeling is related to 3D objects)
    - **Question 4 (Section B):** Discuss the strength and weakness of the human visual system. Describe Spline representation for the curve. (Spline representation of curves falls under 3D object representation).
    - **Question 6 (Section B):** Define fractal. Explain the Bezier curve and B-Spline curve. (Bezier and B-Spline curves are key in 3D object representation).
    - **Question 12 (Section B):** What is quadric surface? Compare between diffuse reflection and specular reflection. (Quadric surfaces are 3D shapes, and reflection is discussed in rendering, related to object appearance).
  + **2077:**
    - **Question 2 (Section A):** How polygon table is used in representing polygons? Explain the representations of any three curves.
    - **Question 7 (Section B):** Describe how a polygon can be represented using BSP tree with example.
    - **Question 12 (Section B):** Define blobby objects. Describe about basic illumination models. (Blobby objects are a 3D representation technique).
    - **Question 2 (Section A) from 2078:** What is the method to recognize boundary point and interior point in solid modeling? Describe how BSP recursively subdivided a space into convex sets. (Again, BSP tree as representation)

**Unit 6: Solid Modeling (4 Hrs)**

* + **2080:**
    - **Question 10 (Section B):** What do you understand by Solid Modeling? Explain Binary Space Partition Method.
  + **2078:**
    - **Question 2 (Section A):** What is the method to recognize boundary point and interior point in solid modeling? Describe how BSP recursively subdivided a space into convex sets. (Solid Modeling and BSP are directly related)

**Unit 7: Visible Surface Detections (5 Hrs)**

* + **2080:**
    - **Question 3 (Section A):** Why Liang Barsky Line Clipping Algorithm is efficient than Cohen Sutherland Algorithm? Explain the clipping procedure of Liang Barsky algorithm with suitable example. (Clipping is related to visibility - what parts are seen)
  + **2079:**
    - **Question 2 (Section A):** Differentiate between object space and Image space method of hidden surface removal. Describe the Z-buffer hidden surface removal algorithm.
    - **Question 3 (Section A):** Write the algorithm for Cohen-Sutherland Line clipping. Clip the polygon A (100,150), B (200,250) and C (300,200) with clipping window defined by the coordinates (100,300), (300,300) and (200,100) using Sutherland Hodgeman Polygon Clipping Algorithm.
    - **Question 8 (Section B):** Calculate the total memory required to store a 8 minute video in a SVGA system with 24 bit true color and 25 fps. (Memory calculation is related to frame buffer size, relevant to visible surface determination as it stores the visible pixels)
    - **Question 12a (Section B) from 2079:** Write short notes on BSP Tree (BSP Tree is used in hidden surface removal)
  + **2078:**
    - **Question 8 (Section B):** What is the task of polygon table? Why we have to remove hidden surface? Explain with any one methodology? (Hidden surface removal is the core of Unit 7)
    - **Question 10 (Section B):** What is the advantage of real tin e rendering over offline rendering? Discuss the limitation of Z-Buffer algorithm. (Z-buffer is a hidden surface removal algorithm)
    - **Question 11 (Section B):** Describe the requirement for line clipping. Explain the scan line polygon filling algorithm. (Line clipping and scan-line algorithms are related to visibility and rendering visible surfaces).
  + **2077:**
    - **Question 8 (Section B):** What is the role of ray tracing in visible surface detection? Explain how scan line algorithm is used for back face detection. (Ray tracing and scan-line algorithm are visibility detection methods)
    - **Question 11 (Section B):** Let ABCD be the rectangular window with (0, 0), B(10, 0), C(10, 10) and D(0,10). Use Liang Barsky line clipping algorithm to clip the line XY, where X(-5, 3) and Y(15,9).

**Unit 8: Illumination Models and Surface Rendering Technique (5 Hrs)**

* + **2080:**
    - **Question 11 (Section B):** How a Realistic Image Can be generated in Computer Graphics? Explain Fast Phong Shading.
  + **2079:**
    - **Question 11 (Section B):** Define the term "Rendering" in computer Graphics. Explain Phong Shading Method with its advantage and disadvantage.
    - **Question 12c (Section B) from 2079:** Write short notes on Intensity Attenuation (Intensity Attenuation is part of illumination models).
  + **2078:**
    - **Question 9 (Section B):** Define intensity attenuation. Distinguish between Gouraud shading and Phong shading model.
    - **Question 12 (Section B):** What is quadric surface? Compare between diffuse reflection and specular reflection. (Diffuse and Specular reflection are components of illumination models).
  + **2077:**
    - **Question 3 (Section A):** Define realism in human perception. What is the significance difference between rendering and image synthesis in creating computer generated image? Describe any two polygon rendering methods.
    - **Question 12 (Section B):** Define blobby objects. Describe about basic illumination models. (Basic illumination models are key to rendering).
    - **Question 9 (Section B) from 2078:** Define intensity attenuation. Distinguish between Gouraud shading and Phong shading model. (Again, intensity attenuation and shading models).

**Unit 9: Introduction to Virtual Reality (2 Hrs)**

* + **2080:**
    - **Question 6 (Section B):** What is virtual reality? Explain some form of virtual reality. (Also potentially related to Unit 5, but VR as a topic is in Unit 9).
  + **2079:**
    - **Question 12b (Section B):** Write short notes on Virtual Reality.
  + **2078:**
    - **Question 3 (Section A):** List some significances of virtual reality. Differentiate between virtual reality and augmented reality with example. Demonstrate how a polygon can be created using OpenGL.
  + **2077:**
    - **Question 9 (Section B):** How virtual realities differ with our real world? Describe some components of VR system.

**Unit 10: Introduction to OpenGL (3 Hrs)**

* + **2080:**
    - **Question 12a (Section B):** Write short notes on OpenGL.
  + **2078:**
    - **Question 3 (Section A):** List some significances of virtual reality. Differentiate between virtual reality and augmented reality with example. Demonstrate how a polygon can be created using OpenGL. (OpenGL is mentioned in the context of a practical application).
  + **2077:**
    - **Question 10 (Section B):** Write a procedure to draw a line in OpenGL? Describe Painter's algorithm. (Painter's algorithm is visibility, but the question is framed around OpenGL implementation).

**Other General/Mixed Questions:**

* + **2080:**
    - **Question 4 (Section B):** Write down algorithm steps of mid-point ellipse drawing algorithm. (Could be Unit 2, but algorithm questions are generally applicable).
    - **Question 9 (Section B):** Calculate the total memory required to store a 5 minute video in a SVGA system with 24 bit true color and 30 fps. (Relates to raster graphics fundamentals, could be Unit 1 or 7).
    - **Question 12b (Section B):** Write short notes on Flynn's Classification (General Computer Architecture knowledge, less directly CG).
  + **2079:**
    - **Question 5 (Section B):** Differentiate between Raster and Vector graphics method. (Fundamental concept, Unit 1 or 2).
  + **2077:**
    - **Question 4 (Section B):** Differentiate between vector and raster graphics. (Fundamental concept, Unit 1 or 2).

**Most Repeated Questions/Topics (Based on these papers):**

* + **Line Drawing Algorithms (DDA, Bresenham's):** Asked in almost every year, often with tracing or comparison.
  + **Circle/Ellipse Algorithms (Midpoint):** Appears multiple times.
  + **Transformations (2D & 3D):** Translation, Rotation, Scaling, Reflection, Composite Transformations, especially in 2D, and understanding projections (Orthographic, Parallel, Perspective).
  + **Clipping (Line & Polygon):** Cohen-Sutherland, Liang-Barsky, Sutherland-Hodgeman algorithms are frequently tested.
  + **Polygon Representation (Polygon Tables, Meshes):** Understanding how polygons are stored and used for 3D objects.
  + **Curves (Bezier, B-Spline):** Properties and representation of these curves are important.
  + **Hidden Surface Removal (Z-buffer, BSP Tree, Scan-line, Painter's Algorithm):** Various techniques and their comparisons are regularly asked.
  + **Shading Models (Phong, Gouraud):** Understanding illumination models and shading techniques is a recurring theme.
  + **Virtual Reality (Concept & Components):** Basic understanding and definition of VR.
  + **OpenGL (Basic Concepts):** Short notes or simple procedure questions related to OpenGL introduction.