Name:

Enrolment No:

UPES

End Semester Examination, May 2023

Course: Computer Graphics **Semester: IV**

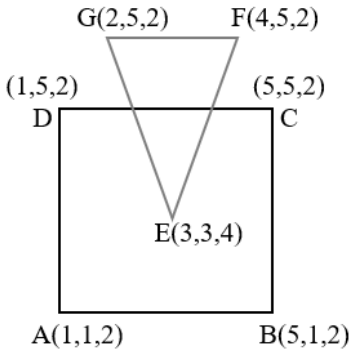
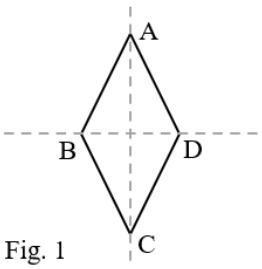
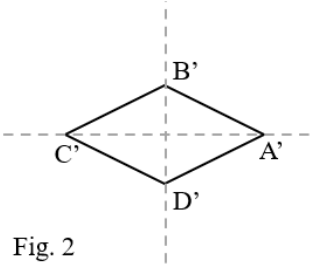
Program: B.Tech, CSE (All Spl.) **Time: 03 hrs.**

Course Code: CSEG2030 **Max. Marks: 100**

Instructions: Attempt all the questions. Q. No. 6 and 11 have internal choices. Calculators are allowed.

SECTION A
(5Qx4M=20Marks)

S. N.		Marks	CO
Q 1	In a 256 gray-levels frame buffer architecture, the number of bit planes required is ____. To design such a gray-level frame buffer system for a 640X480 display, the amount of memory required in Kilobytes (KB) is _____. (Fill up the blanks)	**4**	**CO1**
Q 2	Consider a raster system with resolution of 1280×1024. Determine the number of pixels that could be accessed per second in this system by a display controller that refreshes the screen at a rate of 60 frames per second.	**4**	**CO1**
Q 3	Write a DDA pseudocode or algorithm to scan convert a dashed (_ _ _) line segment.	**4**	**CO2**
Q 4	In the context of curves, differentiate between interpolation and approximation.	**4**	**CO4**
Q 5	Diffused reflection at a point is given as $I = I_s K_d \cos(\theta)$. Here, θ is the angle between_____vector and_____vector. The range of diffusion reflection coefficient K_d is _____.	**4**	**CO5**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Scan convert an ellipse in the first quadrant. The ellipse is specified by the equation $\frac{x^2}{64} + \frac{y^2}{36} = 1$.	**10**	**CO2**
	OR		
	Scan convert a circle in the second quadrant. The circle is expressed by the equation $(x-3)^2 + (y-8)^2 = 81$.	**10**	**CO2**
Q 7	Express the way to determine whether a point (x, y) falls on to the left of a given edge. Execute the Sutherland-Hodgman algorithm to clip the triangle EFG against the clipping window ABC and show the final set of ordered vertices of the clipped polygon. The coordinates of the ABC are A(0, 0), B(4, 0), and C(4,4). Vertices of the subject polygon EFG are specified as E(3, 2), F(3,–2), and G(5, 0).	**2, 8**	**CO3**

Q 8	Define a spline. Construct a Bezier curve with control points A (0, 0), B(1, 2), C(3, 2), and D(2, 0). Generate five points of the curve.	**2, 8**	**CO4**
Q 9	Explain the Phong shading procedure to compute intensity at each pixel of a surface. Does mach-band effect appear in Phong shading? Justify.	**8, 2**	**CO5**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	(a) Define polyhedron. State the back-face culling logic to determine whether a polyhedron surface is facing back. Give a rational for the usage of back-face culling method. (b) Consider the two surfaces, ABCD and EFG, in the figure given below. Find the intensity at pixel (3, 4) using z-buffer visible surface detection algorithm. Intensities of the surfaces ABCD and EFG are 20 and 30, respectively.  	**8, 12**	**CO4**
Q 11	(a) The vertices of a diamond shaped object are A(0, 4), B(–2, 0), C(0, –4), and D(2, 0)(Fig. 1). Establish the transform to rotate this object about its center so that it appears as shown in Fig. 2. Find the vertices of the rotated diamond.  Fig. 1  Fig. 2 (b) Determine the normalization transformation that maps vertices defined in world coordinate system (WCS) window **W** to a display window **D** in Device Coordinate System (DCS). Lower left and upper right corners of W and D are **(–5, –5)**, **(5, 5)** and **(0, 0)**, **(200, 200)**, respectively.	**10, 10**	**CO3**
	OR		
	(a) Determine a composite transformation matrix to align a vector V = 3**I** – 2**J** + **K** with vector N = **I** + **J** + **K**. (b) Show that the reflection about the line $y = x$ is attained by reversing coordinates. That is, $M_L(x, y) = (y, x)$.	**12, 8**	**CO3**