## **Question Paper**

Exam Date & Time: 30-May-2023 (02:30 PM - 05:30 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY 2023

**COMPUTER GRAPHICS [ICT 4033]** 

Α

Marks: 50

Duration: 180 mins.

## Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)		Apply Sutherland-Hodgman polygon clipping algorithm to clip the polygon ABCDE against the window PQRS. The coordinates of the polygon are: A(80, 200), B(220, 120), C(150, 100), D(100,	(5)
	A)	30), E(10, 120). Coordinates of the window are: P(200, 50), Q(50, 150), R(200, 150), S(50, 50)	
	B)	Explain the composite matrix for two-dimensional pivote point rotation	(3)
	C)	Illustrate depth buffer algorithm for hidden surface removal	(2)
2)		Explain Cohen-Sutherland line clipping algorithm for line clipping. Trace your algorithm to clip the line against the window defined with $x_{min}$ =-3, $y_{min}$ =1, $x_{max}$ =2, $y_{max}$ =6 and with the line coordinates	(5)
	A)	A(-4, 2) and B(-1, 7)	
	B)	Explain projected coordinates in parallel projection using parametric equations. Represent the homogeneous coordinates using matrix representation	(3)
	C)	Given the following data: $P_0$ (view or eye point), $P_{ref}$ (Centre or look at point) and V(view up vector), derive uvn 3D viewing coordinate reference point	(2)
3)		Explain and compare the following shading models	(5)
	A)	i. Constant shading	
		ii. Faceted shading	
		iii. Gouraud shading	
		iv. Phong shading	
	B)	Find the transformation of triangle A(2,1), B(1,2), C(3,3) by	(3)
		i. Rotating $45^0$ about the origin and then translating one unit in x and y direction.	
		ii. Translating one unit in x and y direction and then rotating $48$ about the origin	
	C)	Explain 3D viewing pipeline with all the necessary steps	(2)
4)		Answer the following questions:	(5)
	A)	i. Write the architecture of OpenGL . Describe the steps.	
		ii. Write an OpenGL program to implement a spinning square preserving the aspect ratio	

	B)	A homogeneous coordinate point $P(3,2,1)$ is transformed in x, y and z direction by -2, -2 and -2 respectively, followed by successive rotation of $60^0$ about x - axis. Find the final coordinates of the transformed point.	(3)
	C)	Given a view plane with $z=z_{vp}$ and R, the projection of reference point, derive equations for obtaining $x_p$ and $y_p$ of the point P on the view plane	(2)
5)		Explain the blending function for Bazier curve. Generate a Bazier curve controlled by the points $A(2,2)$ , $B(3,4)$ , $C(5,4)$ , $D(7,5)$	(5)
	A)		
	B)	Explain different algorithms to fill polygons. Compare and contrast between them	(3)
	C)	Explain ray tracing model with a neat diagram. Write ray tracing and recursive ray tracing algorithms	(2)

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