K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:IV
Class:SY	Program:B.Tech
Branch Code:ROB	Pattern:2023
Name of Course:Computer Graphics for Robotics	Course Code:2312212
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

		Marks	**CO**
Question No. 1			
1a)	Determine the point of intersection of the line AB and CD having co-ordinates A(1, 3, 0.143) B(2, 5, 7), C(-3, 4, 1), D(1, 2, -3) or show that the lines do not intersect.	(6)	CO1
Question No. 2			
2a)	Perform 50° rotation of a triangle *A* (1, 5), *B* (6, 3), *C* (5, 8) about the point C.	(6)	CO2
Question No. 3			
3a)	For the data given below, use Lagrange Interpolation method to estimate Y for X = 2 . X =[1 3 4]; Y = [10 14 21]	(8)	CO2
	OR		
3b)	What is Lagrange interpolation method? Write formulae for first order and second order interpolation. Also state the properties and applications of Langrage interpolation method.	(8)	CO2
3c)	For the following data, use inverse distance weighting method to interpolate at $x = 8$, $y = 15$.	(8)	CO2

x	5	12	15	23
y	10	7	13	28
z	69	25	98	47

OR

3d)	Explain the application of quaternions to obtain the combined roll, pitch and yaw motion of a robot gripper.	(8)	CO2

Question No. 4

4a) What is sweep surface? Formulate a mathematical formulation to generate it. Explain with suitable example. (8) CO3

OR

4b) A line with end point (1, 5, 0) and (4, 7, 0) is simultaneously revolved about x-axis by 360° and translated along x-axis by 10 units to generate sweep surface. Obtain the point on this sweep surface for $t = 0.2$ and $s = 0.3$. Where t is parameter for line and s is parameter for revolution and translation. (8) CO3

4c) Obtain x co-ordinate of a point on the Bezier surface patch at u=0.4 and v= 0.6 using following control points: (8) CO3

$$\begin{bmatrix} (2,5,12) & (5,5,6) & (8,5,6) \\ (2,8,5) & (5,8,12) & (8,8,5) \\ (2,3,6) & (5,3,5) & (8,3,12) \end{bmatrix}$$

OR

4d) For the control points (1, 3), (2, 4), (3, 1), (4, 2), (5, 4). Determine the x and y co-ordinates of a point on cubic B-spline curve for its second segment at parameter value t =0.4. (8) CO3

Question No. 5

5a) Explain following terms related to Geometric algebra (8) CO4

i) Multi vector

ii) Outer product

iii) Inner product

iv) Geometric product

OR

5b) Derive an expression to show the basis blades of a bi-vector in 3D space. (8) CO4

5c) Obtain the outer and inner product of vectors $u = [4\ 6\ 5\ 2]^T$ and $v = [5\ 10\ 8\ 4]^T$ (8) CO4

OR

5d) Explain the applications of Geometric algebra in robotics (8) CO4

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