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

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

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:III
Class:SY	Program:B.Tech
Branch Code:ROB	Pattern:2022
Name of Course:Computer Graphics for Robotics	Course Code:ROB222004
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 2 page(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.

Question No. 1 Attempt following Question

1a) A plane contains vectors $a = i - j + 3k$ and $b = i - 2k$. A point in the plane is (1, 3, 2). Obtain the equation of plane. (6) CO1

Question No. 2 Attempt following Question

2a) Perform 55° rotation of a rectangle A (1, 3), B (5, 2), C (4, -1), and D (-2, 5) about the point A (6) CO2

Question No. 3 Attempt following Question

3a) A quaternion q_1 rotates 0° about Y axis and quaternion q_2 rotates 90° about Y axis. Obtain the interpolation quaternion at parameter $t = 0.4$ (8) CO3

OR

3b) Explain the application of Inverse distance weighting method for surface generation. Also state its limitations (8) CO3

3c) Use forward difference interpolation to interpolate at $x = 3.5$ for following data: (8) CO3

x	2	4	6	8
y	5	9	11	17

OR

3d) Write short notes on: (i) Finite difference method (ii) nearest neighbor method for 3D surface generation (8) CO3

Question No. 4 Attempt following Question

4a)	Obtain x-y co-ordinates of a point on Bezier curve at parameter value t=0.3 considering control points as (1, 2), (4, 8), (5, 3) and (7, 12)	(8)	CO2, CO3

OR

4b)	Obtain x, y, and z co-ordinate of a point on the B spline surface patch at u=0.5 and v= 0.5 using following control points:	(8)	CO2, CO3

$$\begin{bmatrix} (2,8,5) & (4,8,10) & (6,8,14) & (8,8,6) \\ (2,6,12) & (4,6,8) & (6,6,10) & (8,6,15) \\ (2,4,8) & (4,4,12) & (6,4,8) & (8,4,5) \\ (2,2,4) & (4,2,8) & (6,2,5) & (8,2,10) \end{bmatrix}$$

4c)	Explain the applications of B spline and Bezier curves in robot path planning	(8)	CO2, CO3

OR

4d)	A line with end point (1, 2, 0) and (4, 4, 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 = 0.4 and s = 0.2. Where t is parameter for line and s is parameter for revolution and translation	(8)	CO2, CO3

Question No. 5 Attempt following Question

5a)	Explain the Application of analytic geometry in robotics	(8)	CO4

OR

5b)	Demonstrate with example, the outer product of 2 vectors in 3 dimensional space.	(8)	CO4
5c)	Show that the multiplication of basis blades e_{12} and e_{23} is e_{13}	(8)	CO4

OR

5d)	Write note on: (i) Rotation vector (ii) Reflection vector	(8)	CO4

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