

Total No. of Questions : 8]

SEAT No. :

P1613

[6002]-243

[Total No. of Pages : 2

S.E. (Robotics and Automation)
COMPUTER GRAPHICS FOR ROBOTICS
(2019 Pattern) (Semester - IV) (211512)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

Q1) a) Use cubic spline interpolation to obtain y at $x=5$ for the following data: **[12]**

X	3	4.5	7	9
Y	2.5	1	2.5	0.5

b) With suitable examples, explain the application of inverse distance weighting method for 3D surface generation. **[5]**

OR

Q2) a) A point $(0,1,1)$ is rotated by 90° using a quaternion coincident with y axis. Determine the transformed position of the point. **[12]**

b) Explain 2D interpolation methods. **[5]**

Q3) a) Obtain x, y and z co - ordinate of a point on the Bazier surface patch at $u = 0.5$ and $v = 0.5$ using following control points: **[9]**

$$\begin{bmatrix} (0, 0, 0) & (1, 1, 0) & (2, 0, 0) \\ (0, 1, 1) & (1, 2, 1) & (2, 1, 1) \\ (0, 0, 2) & (1, 1, 2) & (2, 0, 2) \end{bmatrix}$$

b) Explain the applications of Bezier curves in robot path planning. **[8]**

OR

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Q4) a) What are B - spline curves? How the geometric continuity is determined for B - spline curves? [7]

b) Find the midpoint (i.e. point at parameter $t = 0.5$) of a Hermite cubic spline with two end points as (1,1) and (6,5) and corresponding tangent vectors as (0,4) and (4,0). [10]

Q5) a) Determine the angle between a line $a = i + j$ and a plane $x + y + z - 1 = 0$. [10]

b) Given $y = 2x + 1$, what is the Hessian normal form? [8]

OR

Q6) a) Obtain a point (P) in a plane parallel to XZ plane and containing point (1,1,1). Assume the values of arbitrary scalars for two vectors as 2 and 1 respectively. [12]

b) Write note on: Intersection of a circle with a straight line. [6]

Q7) a) What do you mean by an outer product? What are the properties of outer product? [9]

b) Show that the multiplication of basis blades e_{12} and e_{13} is $-e_{23}$. [9]

OR

Q8) a) Write short note on: Rotation and reflection. [9]

b) Explain the applications of applied geometric algebra for modelling of robotics physics. [9]

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