

Total No. of Questions : 8]

SEAT No. :

PD-4157

[Total No. of Pages : 2

[6402]-118

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) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.
- 2) Figures to the right side indicate full marks.
- 3) Use of Calculator is allowed.
- 4) Assume the suitable data, if necessary.
- 5) Neat diagrams must be drawn wherever necessary.

Q1) a) For the following data, predict  $y$  at  $x = 1.5$  using forward difference method. [12]

|     |   |   |   |    |
|-----|---|---|---|----|
| $x$ | 1 | 3 | 5 | 7  |
| $y$ | 8 | 5 | 6 | 10 |

b) Explain with suitable example, the application of finite difference method for 3D interpolation. [5]

OR

Q2) a) For the following data, use inverse distance weighting method to interpolate at  $x = 2, y = 1$ . [10]

|     |    |    |    |     |
|-----|----|----|----|-----|
| $x$ | 0  | 1  | 2  | 3   |
| $y$ | 1  | 3  | 2  | 2   |
| $z$ | 20 | 58 | 23 | 105 |

b) Explain with suitable example: Lagrange method of interpolation. [7]

Q3) a) A line with end point (3, 5, 0) and (6, 2, 0) is revolved about  $x$ -axis by  $360^\circ$  to generate surface of revolution. Obtain the point on this surface for  $t = 0.4$  and  $s = 0.6$ . Where  $t$  is parameter for line and  $s$  is parameter for revolution. [7]

b) Explain with suitable example the steps to obtain  $x, y$ , and  $z$  co-ordinate of a point on the quadratic Bazar surface patch using given control points. [10]

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OR

**Q4) a)** Explain the applications of B spline and Bezier curves in robot path planning. [10]

b) Derive an equation of a point on Cubic spline surface in matrix form. [7]

**Q5) a)** Determine the point of intersection of following two lines: Line AB: A(6,8,4), B(12,15,4) and Line CD: C(6,8,2), D(12,15,6). [10]

b) Explain the method to obtain equation of line of intersection of two given planes. [8]

OR

**Q6) a)** A plane contains vectors  $a = 5i + 32j - 2k$  and  $b = i + 2k$ . A point in the plane is (2, 3, 1). Obtain the equation of plane. [10]

b) A triangle has vertices P1(2, 3), P2(5, 5), P3(4, 7). Determine whether point P(3, 5) lies inside the triangle, outside triangle or on the edge. If it is on the edge then mention that edge. [8]

**Q7) a)** Demonstrate with example, the outer product of 2 vectors in 3 dimensional space. [9]

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

OR

**Q8) 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]

