Total No. of Questions : 8] **SEAT No. :**

P718 **[Total No. of Pages : 2**

[5869]-390
S.E. (Robotics & 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) ***Assume suitable data if necessary.***
4) ***Use of calculator is allowed.***

Q1) a) The specific volumes (v) of superheated steam is listed in table below for various temperatures (T) at a pressure of 20 bar absolute. Determine v at T = 750°F using Lagrange interpolation method. **[9]**

T,°F	700	720	740	760
v,cm^3/gm	6.099	7.606	8.777	9.681

b) Derive an expression for interpolating function of a Hermite Cubic interpolation. **[8]**

OR

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

x	0	1	2	4
y	1	3	2	2
z	20	58	23	105

b) Write note on: Interpolating quaternions. **[7]**

Q3) a) Obtain x-y co-ordinates of a point on Bezier curve at parameter value t = 0.3 considering control points as (1, 4), (3, 6), (4, 2) and (5, 10). **[10]**

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

OR

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Q4) a) Obtain x, y and z co-ordinate of a point on the quadratic Bazier surface patch at u = 0.3 and v = 0.7 using following control points: **[8]**

P_{00}= (0, 0, 0) P_{01}= (1, 1, 0) P_{02}= (2, 0, 0)

P_{10}= (0, 1, 1) P_{11}= (1, 2, 1) P_{12}= (2, 1, 1)

P_{20}= (0, 0, 2) P_{21}= (1, 1, 2) P_{22}= (2, 0, 2)

b) Explain the applications of B spline and Bezier curves in robot path planning. **[9]**

Q5) a) Obtain an equation of a plane inclined to Y axis and X axis by 45°. The plane is parallel to X axis and contains a point (0, 0, 2). **[10]**

b) Determine the point of intersection of two lines AB and CD having co-ordinates of point A(3, 1, 2), point B(4, 4, 6), point C(2, 1, 5) and point D(3.857, 2.285, 2.428). Consider parameter *t* for line AB as 0.7 and parameters for line CD as 0.3. **[8]**

OR

Q6) a) Obtain the equation of a line of intersection of XY plane and YZ plane. Consider the point (0, 3, 2) is in YZ plane and point (3, 2, 0) is in XY plane. **[10]**

b) A triangle has vertices P_1(l, 2), P_2(4, 4), P_3(3, 6). Determine whether point *P*(2, 4) lies inside the triangle, outside triangle or on the edge. If it is on the edge then mention that edge. **[8]**

Q7) a) Obtain the table containing all basis blades in 3 dimension. **[9]**

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

OR

Q8) a) Show that the multiplication of basis blades e_{12} and e_{13} is $-e_{23}$. **[9]**

b) Write short note on: Outer product of 3D vectors. **[9]**

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