

**BACHELOR OF SCIENCE (COMPUTER SCIENCE) (CBCS - 2018 COURSE)**  
**S.Y.B.Sc.(Computer Science) Sem-IV :SUMMER- 2022**  
**SUBJECT : COMPUTATIONAL GEOMETRY**

Day : Wednesday

Time : 03:00 PM-06:00 PM

Date : 6/7/2022

**S-20105-2022**

Max. Marks : 60

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**N.B.:**

- 1) All questions are **COMPULSORY**.
  - 2) Figures to the right indicate **FULL** marks.
  - 3) Use of non-programmable **CALCULATOR** is allowed.
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**Q.1** Attempt **ANY TWO** of the following: **(12)**

- a) Prove that mid-point of the line segment AB is transformed to the mid-point of segment  $A^* B^*$  under  $2 \times 2$  transformation matrix  $[T]$ .
- b) Obtain the transformation matrix for the reflection through  $x=5$  plane.

Apply it on the object  $[X] = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ .

- c) Find the concatenated transformation matrix for the following sequence of transformations: Shearing in x and y- directions by  $-2$  and  $3$  units respectively, followed by translation in x and y- direction by  $-3.2$  and  $1.6$  units respectively, followed by scaling y co-ordinate by factor  $4$ .

**Q.2** Attempt **ANY TWO** of the following: **(12)**

- a) Write an algorithm for reflection of an object through an arbitrary plane in space.
- b) Determine the isometric projection for  $\phi = -45^\circ, \theta = -35.26^\circ$ . Apply it on  $P[1 \ 2 \ 1]$ .
- c) Obtain transformed position vectors of the vertices of  $\Delta ABC$ , when  $\Delta ABC$  is rotated through an angle  $90^\circ$  about the local X- axis passing through  $A[-1 \ 2 \ 2 \ 1], B[2 \ 1 \ 2 \ 1], C[2 \ 3 \ 2 \ 1]$ .

**Q.3** Attempt **ANY TWO** of the following: **(12)**

- a) Obtain an algorithm to generate uniformly spaced n points on the circle  $(x-h)^2 + (y-k)^2 = r^2$ .
- b) Generate 5 points on the parabolic segment in the first quadrant for  $2 \leq y \leq 10$  for the parabola  $y^2 = 4x$
- c) Find the parametric equation of the Be'zier curve with control points  $B_0[-2 \ 1], B_1[1 \ 3], B_2[6 \ -1]$ . Also find the point corresponding to the parameter value  $t=0.357$ .

**P.T.O.**

**Q.4** Attempt **ANY THREE** of the following: (12)

- a) Find an angle  $\delta\theta$  to generate uniformly spaced 5 points on the circumference of a circle in the second and third quadrant.
- b) Explain terms:
  - i) Centre of projection
  - ii) Parallel projection
- c) Obtain recursive formula to generate equispaced 10 points of the ellipse  $\frac{x^2}{4} + \frac{y^2}{9} = 1$ .
- d) Find the parametric equation of the Be'zier curve determine by the control points  $B_0[1 \ 0]$ ,  $B_1[2 \ 5]$ ,  $B_2[4 \ 6]$  and  $B_3[6 \ 2]$ .

**Q.5** Attempt **ANY FOUR** of the following: (12)

- a) The line segment joining  $A[4 \ 9]$  and  $B[-2 \ 1]$  is scaled uniformly by factor 2. What is the mid-point of the transformed line segment?
- b) State true or false:  
"Two parallel lines may intersect after any transformation." Justify with proper example.
- c) Develop the bottom view of the object in three dimensional transformation.
- d) Write the transformation matrix for each of the following:
  - i) Rotation about z- axis through an angle  $\theta = -25^\circ$ .
  - ii) Reflection through XY- plane.
- e) Determine the parametric representation of the line segment between  $P_1[3 \ 4]$  and  $P_2[5 \ 2]$ . Also determine the slope and tangent vector of the line segment.
- f) Write any two applications and properties of Be'zier curve.

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