

**[5902]-43****S.Y. B.Sc. (Computer Science)****MATHEMATICS (Paper - I)****MTC-241: Computational Geometry  
(2019 Pattern) (Semester - IV) (24221)***Time : 2 Hours]**[Max. Marks : 35**Instructions to the candidates :*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 2) *Non-programmable scientific calculator is allowed.*

**Q1)** Attempt any Five of the following :**[5 × 2 = 10]**

- a) Find homogenous co-ordinate of point A = [1, 2].
- b) If  $A(\Delta ABC) = 5$  sq. unit is reflected through  $y = x$  line, find Area of transformed object.
- c) Find Foreshortening factor  $f_y$  of the transformation Matrix for Axonometric projection.

$$[T] = \begin{bmatrix} 0.5 & 0.43 & 0 & 0 \\ 0 & 0.86 & 0 & 0 \\ 0.86 & 0.25 & 0 & 0 \\ 0.58 & 0.75 & 0 & 1 \end{bmatrix}$$

- d) Find direction cosines of the plane  $x + y + z = 0$ .
- e) Write types of all Axonometric parallel projections.
- f) Define projection in three-Dimensional space.
- g) Find Initial point of part of circle  $x^2 + y^2 = 16$  in second quadrant.

**Q2)** Attempt any three of the following :

**[3 × 5 = 15]**

a) Show that  $2 \times 2$  matrix  $[T] = \begin{bmatrix} 2t & \frac{1}{t} \\ t & \frac{1}{t} \end{bmatrix}$

represents pure rotation in two-Dimensional space.

- b) If circle  $(x-1)^2 + (y+1)^2 = 9$  is transformed by translation in X-direction by 2 and Y-direction by 3 then find centre of transformed circle.
- c) Find concatenated transformation matrix for the following sequence of transformation, First shearing in Y-direction proportional to  $x$  and  $z$  co-ordinate with 1 and 3 units respectively. Followed by Reflection through  $xz$  plane (i.e.  $y = 0$  plane).
- d) Obtain transformation matrix to Reflect the object through plane  $x = -2$ .
- e) Develop the bottom view of the line segment AB where  $A = [0 \ 0 \ 1]$  and  $B = [1 \ 0 \ 1]$ .

**Q3)** Attempt any one of the following :

**[1 × 10 = 10]**

- a) Find the parametric equation of Be'zier curve determine by four control points  $B_0 [0 \ 2]$ ,  $B_1 [2 \ 3]$ ,  $B_2 [3 \ 2]$  and  $B_3 [2 \ 0]$ . Also find position vectors of the point on the curve corresponding to parametric values  $t = 0.2, 0.4, 0.6$ .
- b) i) Generate equispaced 3 points on the circle  $x^2 + y^2 = 36$  in second quadrant only.
- ii) Write the transformation matrix for dimetric projection with  $f_z = \frac{3}{8}(\theta > 0, \phi > 0)$ .



[5823]-403

**S.Y. B.Sc. (Computer Science)****MATHEMATICS****MTC-241 : Computational Geometry****(2019 Pattern) (Semester - IV)***Time : 2 Hours]**[Max. Marks : 35**Instructions to the candidates:*

- 1) *All Questions are compulsory.*
- 2) *Figures to the right indicates full marks.*
- 3) *Non-programmable scientific calculator is allowed.*

**Q1)** Attempt any five of the following.**[5 × 2 = 10]**

- a) Write transformation matrix of rotation about origin through an angle  $45^\circ$  in clockwise direction.
- b) Find the slope of line which is perpendicular to the line  $2x + y = 3$ .
- c) Find point in three dimensional space whose homogenous co-ordinate is  $\begin{bmatrix} 1 & 2 & 3 & \frac{1}{2} \end{bmatrix}$ .
- d) Write matrix of overall scaling by factor 3 in three dimensional space.
- e) Define foreshortning factors in projection.
- f) If foreshortning factor along z-direction is  $F_z = \frac{1}{2}$ . What is the angle  $\phi$  required to rotate about Y-axis to construct a dimetric projection.
- g) Write any two properties of Be'zier curve.

**Q2)** Attempt any three of the following :**[3 × 5 = 15]**

- a) Obtain concatenated transformation matrix [T] for Axonometric projection.
- b) If the line segment AB is scaled uniformly by factor 3 then find mid-point of transformed line segment A'B'. Where  $A = [4 \ 9]$  and  $B = [3 \ 2]$ .



- c) Obtain combined transformation matrix for the following sequence of transformation. First Reflection through x-axis, followed by Rotation about origin through an angle  $270^\circ$ , followed by scaling in x and y direction by factors 2 and -1 units respectively.
- d) Obtain transformation matrix to Reflect the object through plane  $x = -2$ .
- e) Obtain transformation matrix to rotate the line which is parallel to y-axis and passing through point  $(0, 4, 0)$ , by an angle  $\theta = 45^\circ$ .

**Q3)** Attempt any one of the following : **[1 × 10 = 10]**

- a) Generate equispaced 4 point on the curve of circle  $(x - 1)^2 + (y + 1)^2 = 9$ .
- b) i) Find parametric equation of curve determine by control points  $B_0[3, 4]$ ,  $B_1[0, 1]$  and  $B_2[2, -1]$ . Also find position vector of the point on the curve corresponding to parametric value  $t = 0.3$ .
- ii) Write the transformation matrix for dimetric projection with

$$F_c = \frac{3}{8} (\theta > 0, \phi > 0).$$

