Total No. of Questions—4] [Total No. of Printed Pages—4

Seat No.	

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S.Y. B.Sc. (Computer Science) (Second Semester)

EXAMINATION, 2017

MATHEMATICS

Paper I

(MTC-221 : Computational Geometry)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

***N.B.* :—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of single memory, non-programmable scientific calculator is allowed.

1. Attempt any *five* of the following : [10]

(*a*) Write the 2×2 transformation matrix [T] for reflection through the line $y = -x$. Apply it on the point $P[-2 \ \ 5]$.

(*b*) Find the point of intersection at infinity for the lines :

$$x + y = 5 \text{ and}$$
$$2x + 2y = 4.$$

(*c*) Write the 3×3 transformation matrix for shearing in z direction proportional to x and y co-ordinates by 12 and 14 units respectively.

P.T.O.

(*d*) Defnie control points.

(*e*) What are the types of oblique projection ?

(*f*) Determine the increment in angle θ to generate equally spaced 11 points on the arc of the circle,

$$x^2 + y^2 = 25$$

in second quadrant.

(*g*) State any *two* properties of Bezier curve.

2. Attempt any *two* of the following : [10]

(*a*) If the Δ ABC with vertices A[3 4], B[1 1] and C[6 1] is first reflected through X-axis and then uniformly scaled by 10 units, then find the area of the resulting Δ $A^x B^x C^x$.

(*b*) Find the combined transformation matrix [T] for the following sequence of transformations :

(*i*) Rotation about the origin through 120°.

(*ii*) Reflection through the origin.

(*iii*) Shearing in Y-direction by 2 units.

Apply it on the point P[14 17].

(*c*) If the line

$$y = mx + k$$

is transformed to the line

$$y^x = m^x x^x + k^x$$

under a 2×2 transformation matrix

$$[T] = \begin{bmatrix} a & b \\ c & d \end{bmatrix},$$

then prove that :

$$k^x = \frac{k(ad - bc)}{a + cm}.$$

3. Attempt any *two* of the following : [10]

(*a*) Derive the expression for the angles ϕ and θ in dimetric projection.

(*b*) Obtain the concatenated transformation matrix [T] for the following sequence of transformations :

(*i*) Translation in x, y and z directions by 5, 10 and 15 units respectively.

(*ii*) Perspective projection with the centre of projection at $x_c = 4$ on x-axis.

(*iii*) Scaling in y-coordinate by 3 units.

Apply it on the origin O[0 0 0].

(*c*) Find the angles of rotation about x-axis and y-axis so that the plane

$$x + 2y + 2z = 0$$

coincides with the $z = 0$ plane.

4. Attempt any *one* of the following : [10]

(*a*) (*i*) Write the parametric equation of the Bezier curve with the control points

$B_0[-1 \ \ 1]$, $B_1[0 \ \ 4]$, $B_2[3 \ \ 4]$ and $B_3[3 \ \ 1]$.

Hence find P(0.18) and P(0.27).

(*ii*) Develop the rear view and bottom view of the object :

$$[X] = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & 1 & 1 \end{bmatrix}.$$

(*b*) Generate equally spaced 4 points on the parabolic segment in the second quadrant of the parabola,

$$y^2 = -16x$$

for $-4 \leq x \leq -1$.