

S.Y.B.SC. (Computer Science) SEM –IV (2014 COURSE) : WINTER -  
2018

SUBJECT : COMPUTATIONAL GEOMETRY

Day : Saturday  
Date : 13/10/2018

W-2018-0961

Time : 03.00 PM TO 05.00 PM  
Max. Marks : 40

N.B:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non programmable calculator is **ALLOWED**.

Q.1 Attempt any **TWO** of the following: (10)

- a) If the  $2 \times 2$  transformation matrix transforms the point P and Q to the points  $P^*$  and  $Q^*$  respectively. If R divides segment PQ internally in the ratio m:n then its transformed point  $R^*$  divides segment  $P^*Q^*$  internally in the ratio m:n.
- b) Using the concatenated matrix, reflect the  $\Delta ABC$  through the line  $y = 5$ , where  $A[1, 3], B[2, 4]$  and  $C[3, 5]$ .
- c) Find the concatenated matrix required to make the plane  $x + y + z = 0$  coincident with the  $z = 0$  plane.

Q.2 Attempt any **TWO** of the following: (10)

- a) Write an algorithm for reflection through plane passing through  $A[x_0, y_0, z_0]$  and parallel to yz-plane.
- b) Find the cavalier projection with  $\alpha = 30^\circ$  and cabinet projection with  $\alpha = 25^\circ$  of the object represented by the matrix,  $X = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$ .
- c) Determine the principal foreshortening factor if the matrix for axonometric projection is given by ;

$$T = \begin{bmatrix} 0.87 & 0 & 0 & 0 \\ -0.05 & -0.69 & 0 & 0 \\ 0.08 & -0.74 & 0 & 0 \\ 3.1 & 2.7 & 0 & 0 \end{bmatrix}$$

P.T.O.

**Q.3** Attempt any **TWO** of the following: (10)

- a) Obtain the relation between  $\theta$  and  $f_z$  in diametric projection.
- b) Generate uniformly spaced 3 points on the hyperbolic segment in the first quadrant for  $4 \leq x \leq 8$ , where equation of the hyperbola is  $\frac{x^2}{4} - \frac{y^2}{16} = 1$ .
- c) Find parametric equation of Be'zier curve determined by control points  $B_0[0 \ 2], B_1[2 \ 3], B_2[3 \ 2], B_3[2 \ 0]$ . Also position vectors of the points on the curve corresponding to parameter value  $t=0.2, 0.4$ .

**Q.4** Attempt any **FIVE** of the following: (10)

- a) Write the transformation matrix for reflection through x-axis.
- b) Define :
  - i) Affine transformation
  - ii) Solid body transformation
- c) Write the transformation matrix for orthographic projection create the top view of the object.
- d) Find the value of  $\delta\theta$  to generate 11 points on the parabolic segment  $y^2 = 4x, 2 \leq y \leq 4$ .
- e) Write parametric equation of Be'zier curve with control points  $B_0, B_1, B_2, B_3$ .
- f) Obtain a relation between  $\phi$  and  $f_z$  in diametric projection.
- g) Write the transformation matrix for shear in x-coordinate by a factor of 6 units proportional to y-coordinate and shear in z-coordinate by a factor of 3 units proportional to x-coordinate.

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