S.Y. B. SC. (Computer Science) SEM –IV (CBCS - 2016 COURSE) : SUMMER - 2019

SUBJECT : COMPUTATIONAL GEOMETRY

Day: - Saturday
Date: 13/04/2019

S-2019-1098

Time: 11.00 AM TO 02.00 PM
Max. Marks: 60

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: **(12)**

a) Show that the transformation matrix for rotation about the origin through an angle θ is $[T]=\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$.

b) If the circle of circumference 14π is uniformly scaled by 3 units, what is the area of the transformed object.

c) Using the concatenated matrix, reflect the ΔABC through the line y =5, where $A[1,\ 3], B[2\ \ 4]$ and $C[3\ \ 5]$.

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

a) Write an algorithm for rotation about an arbitrary axis in space.

b) The plane $x+2y+2z=0$ is to be rotated so that it coincides with the $z=0$ plane. Determine the required angles of rotations about the x-axis and y-axis.

c) Obtain the concatenated transformation matrix for the following sequence of transformation.

i) Rotation about the y-axis through -60^0.

ii) Translate in the Z-direction by 4 units.

iii) Project perspectively from the centre of projection $z_c[0,\ 0,\ 20,\ 1]$ on the z = 0 plane. Apply transformation to the object X;

$$X=\begin{bmatrix} 2 & 3 & 1 & 1 \\ 4 & 0 & 2 & 1 \\ 3 & 1 & 3 & 1 \end{bmatrix}.$$

P.T.O.

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

a) Develop the cavalier and cabinet projection for $\alpha = 120^0$ of the object $X = \begin{bmatrix} 1 & 2 & 2 & 1 \\ 0 & 1 & 2 & 1 \end{bmatrix}$.

b) Determine the principal foreshortening factor if the matrix for axonometric projection is given by ;

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

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 $t = 0.2,\ 0.4,\ 0.6$.

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

a) Write an algorithm to generate equispaced n points on circumference of arc of ellipse with centre at (0, 0), length of semimajor axis is 'a' and length of semiminor axis is 'b'.

b) Obtain equispaced 4 points of circle $(x-1)^2 + (y+2)^2 = 9$.

c) Find standard matrix for isometric projection of and hence obtain isometric projection of object, $X = \begin{bmatrix} 2 & 1 & 1 & 1 \\ 0 & 2 & 1 & 1 \\ 1 & 2 & 2 & 1 \end{bmatrix}$.

d) If $B_0[2\ 1], B_1[4\ 4], B_2[5\ 3], B_3[5\ 1]$ are the vertices of a Be'zier polygon then determine the point $P(0.7)$ of the Be'zier curve.

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

a) Define :
- **i)** Affine transformation
- **ii)** Solid body transformation

b) Obtain transformation matrix for reflection through x=5 plane, then apply it on pyramid.

c) Write the matrix for cabinet projection if the horizontal inclination angle $\alpha=25^0$.

d) Obtain recursive formula to generate equispaced 10 points of the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$.

e) Write a parametric equation of Be'zier curve.

f) Transform the triangle with vertices $A[0\ 0], B[1\ 0], C[0\ 2]$ using overall scaling by factor 3.

* * *