BACHELOR OF SCIENCE (COMPUTER SCIENCE) (CBCS - 2016 COURSE)
S.Y.B.Sc.(Computer Science) Sem-IV : WINTER- 2022
SUBJECT : COMPUTATIONAL GEOMETRY

Day : Saturday | Time : 02:00 PM-05:00 PM

Date : 10/12/2022 | **W-14894-2022** | 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) Using concatenated matrix, reflect the triangle ABC through the line $y=5$ where $A[1\ \ 3]$, $B[2\ \ 4]$ and $C[3\ \ 5]$.

c) Find the combined transformation matrix for the following sequence of transformations:

i) Scaling in x and y co-ordinates by factors –1 and 2 respectively.

ii) Reflection through X-axis.

iii) Rotation about the origin through an angle $\theta=270^0$.

Apply this combined transformation on the point $P[2\ \ -3]$.

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

a) Obtain an algorithm to generate uniformly spaced n points on the circle $x^2+y^2=r^2$.

b) Generate uniformly spaced 8 points on the ellipse, $\frac{x^2}{16}+\frac{y^2}{1}=1$.

c) Generate uniformly spaced three points on the parabolic segment in the first quadrant for $12 \le x \le 27$ for the parabola $y^2=12x$.

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

a) Write an algorithm for reflection through any arbitrary plane in space i.e, plane $ax+by+cz=d$.

b) Consider the line with direction rations 1, 1, 1 and passing through the origin. Determine angles through which the line should be rotated about X-axis and then about Y-axis, so that it coincides with Z-axis.

c) Find parametric equation of a Be'zier curve determined by control points $B_0[2\ \ 1]$, $B_1[4\ \ 3]$, $B_2[6,\ 0.5]$ and hence find the position vector of the point corresponding to parameter value $t=0.43$.

P.T.O.

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

a) Find each of following transformation matrices:

i) Reflection through the line y = x.

ii) Rotation by 55^0 about origin.

iii) Scaling in x co-ordinate by 2 units and y co-ordinate by $\frac{1}{4}$ units.

iv) Shearing in x direction by –2 units.

b) A line $x+y=3$ is transformed to another line by using 2×2 transformation matrix $[T]=\begin{bmatrix}1 & 2\\ 2 & 5\end{bmatrix}$. Obtain the equation of resulting line.

c) For position vectors $P_1[3\ \ 4]$ and $P_2[5\ \ 2]$ determine the parametric representation of the line segment between them. Also determine slope and tangent vector of the line segment.

d) Define:

i) Axonometric projection.

ii) Perspective projection

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

a) Let $A[1\ \ 2]$, $B[3\ \ 6]$, and $[T]=\begin{bmatrix}4 & 1\\ 2 & 5\end{bmatrix}$ be the transformation matrix. Let P divides AB in the ratio 4:3 then find $[P^*]=[P][T]$.

b) Find the value of x on unit circle $x^2+y^2=1$, given that $y=0.866$.

c) Find the value of $\delta\theta$ to generate 11 points on parabolic segment $y^2=4x,\ 2\le y\le 4$.

d) Create bottom view of the object.

e) Write transformation matrices for :

i) Shearing in y co-ordinate proportional to x co-ordinate by factor 4.

ii) Reflection through XY-plane.

f) Write parametric equation of Be'zier curve with control points B_0, B_1, B_2.

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