BACHELOR OF SCIENCE (COMPUTER SCIENCE) (CBCS - 2018 COURSE)
S.Y.B.Sc.(Computer Science) Sem-IV : WINTER :- 2021
SUBJECT: COMPUTATIONAL GEOMETRY

Day : Saturday
Date 22-01-2022 **W-20105-2021**

Time : 02:00 PM-05:00 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) Derive the transformation matrix for rotation about origin through angle θ.

b) Reflect the triangle ABC through the line $3x-y=0$, where $A[-2\ \ -3], B[-10\ \ -6], C[-15\ \ -10]$.

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

i) Rotation about origin through 90^o
ii) Reflection through y- axis
iii) Uniform scaling by factor 2

Apply it on object $[X]=\begin{bmatrix}1 & 2\\ 3 & -1\\ 2 & 1\end{bmatrix}$.

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

a) Obtain the three dimensional transformation matrices for:

i) Translations
ii) Shearing
iii) Scaling
iv) Rotation about an arbitrary axis

b) Find the transformation matrix for the trimetric projection formed by a 40^o rotation about y- axis, followed by 75^o rotation about X-axis and then parallel projection onto z = 0 plane. Also find all foreshortening factors.

c) Reflect the pyramid OABC with $O[0\ \ 0\ \ 0], A[1\ \ 1\ \ 0], B[0\ \ 1\ \ 0], C[0\ \ 0\ \ 1]$ in the plane x = 3.

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

a) Obtain an algorithm to generate uniformly spaced n points on a parabolic segment in the first quadrant for the given range of x co-ordinate where equation of the parabola is $y^2 = 4ax$.

b) Generate 5 uniformly spaced points on the arc of the circle $x^2 + y^2 = 49$ in the second quadrant.

c) Find the parametric equation of a Be'zier curve determine by the control points $B_0[1\ \ 0], B_1[2\ \ 5], B_2[4\ \ 6]$ and $B_3[6\ \ 2]$. Also find the position vector of a point on the curve, for which the value of parameter is t = 0.4

P.T.O.

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

a) Obtain the recursive formula to generate 40 points on the ellipse, $\frac{x^2}{25}+\frac{y^2}{16}=1$.

b) If the line $y=2x+1$ is transformed using the matrix $[T]=\begin{bmatrix} 4 & 2 \\ -1 & 3 \end{bmatrix}$, then find the equation of transformed line.

c) Write any two applications and properties of Be'zier curve.

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

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

a) The line segment joining the points $A[3 \quad 4]$, $B[5 \quad 6]$ is transformed to the line segment $A'B'$ by the transformation matrix $[T]=\begin{bmatrix} 2 & 1 \\ 1 & 4 \end{bmatrix}$. Find the mid-point of $A'B'$.

b) Write each of the following transformation matrices:
- i) Uniform scaling by 3 units
- ii) Shearing in y- direction by 3 units and x-direction by 4 units.
- iii) Reflection through the line $y=-x$.

c) Define: i) Orthographic projection
ii) Oblique projection.

d) Find the concatenated matrix to create the rear view of an object.

e) Write parametric equation of Be'zier curve with control points B_0, B_1, B_2, B_3, B_4 .

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

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