

SUBJECT: COMPUTATIONAL GEOMETRY

Day: - Saturday
Date: 13/04/2019

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

S-2019-1145

N.B.:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.

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

- a) If a 2×2 transformation matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ transforms the line segment AB to the segment $A'B'$. If slope of the line AB is ' m ' then show that slope of transformed line $A'B'$ is $m' = \frac{b+dm}{a+cm}$.
- b) Find the concatenated transformation matrix for the following transformations in order
 - i) Rotation about origin through an angle $\theta = 45^\circ$
 - ii) Reflection through the line $y = x$.
 Apply it on the position vector $[1 \ 2]$.
- c) Find concatenated matrix of the transformation if an object is rotated about the point $[-1 \ 2]$ through an angle π° .

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

- a) Determine ' a ' if the following matrix represents rotation about an axis passing through the origin

$$M = \begin{bmatrix} 0 & \frac{-1}{\sqrt{2}} & \frac{-1}{\sqrt{2}} & 0 \\ \frac{1}{\sqrt{2}} & a & \frac{-1}{\sqrt{2}} & 0 \\ \frac{1}{\sqrt{2}} & \frac{-1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- b) Develop the top view for object whose position vectors are given below:

$$[X] = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 0.5 & 1 & 1 \\ 0.5 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 0.5 & 1 \end{bmatrix}$$

P. T. O.

c) Explain Trimetric projection briefly.

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

a) Obtain an algorithm to generate uniformly spaced n points on the standard ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

b) Obtain first 8 uniformly spaced points on the circle $x^2 + y^2 = 1$.

c) Find the parametric equation of the Be'zier curve where $B_0[0 \ 2]$, $B_1[2 \ 3]$, $B_2[3 \ 2]$ and $B_3[2 \ 0]$ are vertices of the Be'zier polygon and hence find the position vector of point corresponding to parameter values $t = 0.9$.

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

a) Write the transformation matrix for shearing in y - direction.

b) Define foreshortening factor.

c) Write transformation matrix for rotation about x - axis through an angle θ .

d) Write recursion equations of hyperbola.

e) Write parametric equation of Be'zier curve.

f) Write any two properties of B- spline curve.

g) Write transformation matrix for scaling in x - coordinate by factor $1/5$.

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