

S.Y. B. SC. (Computer Science) SEM -IV (CBCS - 2016 COURSE) :
WINTER - 2018

SUBJECT : COMPUTATIONAL GEOMETRY

Day: Saturday
Date: 13/10/2018

W-2018-0922

Time: 03.00 PM TO 06.00 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) Rotate ΔABC about its centroid through an angle 45° , where $A[2, -4], B[3, 0]$ and $C[-2, 1]$.
- c) Develop a concatenated transformation matrix for a reflection through the line $y = 2x - 1$.

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

- a) Write the algorithm for rotation about an arbitrary axis in space.
- b) Find the concatenated matrix required to make the plane $x + y + z = 0$ coincident with the $z = 0$ plane.
- c) Generate uniformly spaced 6 points on the circle $x^2 + y^2 = 16$.

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

- a) Develop the cavalier and cabinet projection for $\alpha = 120^\circ$ of the object
 $X = \begin{bmatrix} 1 & 2 & 2 & 1 \\ 0 & 1 & 2 & 1 \end{bmatrix}$.
- b) Find 5 points on the ellipse with length of semimajor axis $a = 4$ and length of semior axis $b = 1$.
- 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.4 Attempt any **THREE** of the following: (12)

- a) If $B_0[2 \ 1], B_1[4 \ 4], B_2[5 \ 3], B_3[5 \ 1]$ are vertices of a Be'zier polygon then determine the point $P(0.7)$ of the Be'zier curve.
- b) Write an algorithm to generate equispaced n points on circumference of the circle with centre $(0,0)$ and radius r i.e., $x^2 + y^2 = r^2$.
- c) Obtain transformation matrix for reflection through $x = 5$ plane, then apply it on pyramid.
- d) If foreshortening factor along z - direction is $f_z = \frac{1}{2}$, what are the angles ϕ and θ required to rotate about y -axis and x -axis respectively to construct a diametric projection.

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

- a) Determine whether the transformation $[T] = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$ is a solid body transformation? Justify.
- b) Obtain the concatenated matrix for rotation about axis parallel to x -axis.
- c) Obtain a relation between ϕ and f_z in diametric projection.
- 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 a parametric equation of Be'zier curve.
- f) Let X represent n points of the circle $x^2 + y^2 = 1$ and $X^* = XT_1T_2$ represents n points of the circle $(x-5)^2 + (y+3)^2 = 4$. write the transformation matrices T_1 and T_2 to obtain matrix X^* from matrix X .

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