

BACHELOR OF SCIENCE (COMPUTER SCIENCE) (CBCS - 2018 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-20105-2022

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) If the 2×2 transformation matrix transforms the point P and Q to the points P^* and Q^* respectively. If R divides segment PQ internally in the ratio m:n then its transformed point R^* divides segment P^*Q^* internally in the ratio m:n.
- b) Find the concatenated matrix of shearing in x-direction by 2 units followed by translation in x-direction by 2 units and then rotation about origin through an angle 180° .
- c) Obtain the transformation matrix to reflect an object through the line $x+2y=3$.

Q.2 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 ratios 1, -2, 2 passing through the origin. Determine the 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 the cavalier projection with $\alpha=30^\circ$ and cabinet projection with $\alpha=25^\circ$ of the object represented by the matrix, $X = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$.

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

- a) Write an algorithm to generate equispaced n points on circumference of arc of circle with centre at (0,0) and radius r.
- b) Generate uniformly spaced 3 points on the hyperbolic segment in the first quadrant for $4 \leq x \leq 8$, where equation of the hyperbola is $\frac{x^2}{4} - \frac{y^2}{16} = 1$.
- 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 find position vectors of the points on the curve corresponding to parameter value $t=0.2, 0.4, 0.6$.

P.T.O.

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

- a) Obtain the relation between θ and f_z in diametric projection.
- b) Define the following:
 - i) Foreshortening factor
 - ii) Perspective projection
- c) Rotate the line segment AB where $A[3 \ 3 \ 3], B[5 \ 5 \ 5]$ about the local X -axis passing through $P[2 \ 3 \ 1]$ about an angle 75° .
- d) Find an angle $\delta\theta$ to generate uniformly spaced 5 points on the circumference of a circle in the 2nd and 3rd quadrant.

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

- a) The circle with radius 2 units is transformed by using transformation matrix $[T] = \begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$. Obtain the area of transformed figure.
- b) Write the transformation matrix for reflection through plane $y = 4$.
- c) Write the transformation matrix for orthographic projection create the top view of the object.
- 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 parametric equation of Be'zier curve with control points B_0, B_1, B_2, B_3 .
- f) Define :
 - i) Affine transformation
 - ii) Solid body transformation

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