

Time: 2:00 Hours]

[Marks: 35

Instructions for candidates:

1. All questions are compulsory.
2. Figures to right indicate full marks.
3. Non-programmable, single memory scientific calculator is allowed.

Q1) Attempt any five of the following.**[5×2=10]**

- a) Reflect the point $X = [-1, 2]$ through the line $x=y$.
- b) Let $L \equiv 2x + y = 3$. If L is transformed using the transformation matrix T , find slope of the transformed line, where $T = \begin{bmatrix} 2 & 0 \\ -1 & 3 \end{bmatrix}$.
- c) Find the point in three dimensional space whose homogenous coordinates are $P = [1, 12, 3, 2]$.
- d) Write matrix of overall scaling by factor 3 in three dimensional space.
- e) Define foreshortening factors.
- f) Generate isometric projection of $X = \begin{bmatrix} 1 & -3 & 4 \\ 5 & 2 & 7 \end{bmatrix}$.
- g) If 3 points are to be generated on a circular arc in the first quadrant of the circle $x^2 + y^2 = 1$, then with usual notation find $\delta\theta$ and $[x_0, y_0]$.

Q2) Attempt any three of the following.**[3×5=15]**

- a) For a standard dimetric projection, with usual notation, prove that $\sin \theta = \frac{f_z}{\sqrt{2}}, \sin \phi = \frac{f_z}{\sqrt{f_z^2 - 2}}$.
- b) If the line segment AB is scaled uniformly by factor 3 then find mid-point of transformed line segment $A'B'$. Where $A = [4 \ 9]$ and $B = [3 \ 2]$.
- c) Obtain combined transformation matrix for the following sequence of transformation. First Reflection through x -axis, followed by Rotation about origin through an angle 37° , followed by shearing in x and y direction by factors 2 and $1/3$ units respectively.
- d) Reflect the object X through plane $y = 4$, where $X = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 3 & 0 \\ 0 & 2 & 4 \end{bmatrix}$.

- e) Obtain transformation matrix for rotation about local z-axis passing through point (2, 4, 0) by an angle $\theta = 65^\circ$.

Q3) Attempt any one of the following.

[1×10=10]

- a) Generate 5 equispaced points on the circle $(x-1)^2 + (y+2)^2 = 9$.

- b) i) Generate a cavalier and cabinet projection of $X = \begin{bmatrix} 4 & 2 & 6 \\ 0 & 2 & -1 \\ 2 & 1 & 1 \end{bmatrix}$, where angle

of inclination is 23° .

- ii) Find the transformation matrix T for axenometric projection with $\theta=30^\circ$ and $\phi=40^\circ$.
