**Assignment No. 06**

6. Implement following 2D transformations on the object with respect to axis : –

i) Scaling ii) Rotation about arbitrary point iii) Reflection

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| **Aim** |
| Implement translation, sheer, rotation and scaling transformations on equilateral triangle and rhombus. |

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| **Objective(s)** | |
| **1** | 2 D Homogeneous coordinate system |
| **2** | Understand and Implement 2D transformations in Laboratory. |

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| **Theory** |
| 1. **Translation:** Translation is defined as moving the object from one position to another *position along*  *straight line path.*    We can move the objects based on translation distances along x and y axis. tx denotes translation distance along x-axis and ty denotes translation distance along y axis.  Translation Distance: It is nothing but by how much units we should shift the object from one location to another along x, y-axis.  Consider (x,y) are old coordinates of a point. Then the new coordinates of that same point (x’,y’) can be obtained as follows:  X’=x+tx  Y’=y+ty  **2.Scaling:** scaling refers to changing the size of the object either by increasing or decreasing. We will increase or decrease the size of the object based on scaling factors along x and y -axis.  If (x, y) are old coordinates of object, then new coordinates of object after applying scaling  transformation are obtained as:  x’=x\*sx  y’=y\*sy.  sx and sy are scaling factors along x-axis and y-axis. we express the above equations in matrix form as:    **3. Rotation :** A rotation repositions all points in an object along a circular path in the plane centered at the  pivot point. We rotate an object by an angle theta  New coordinates after rotation depend on both x and y  x’ = xcosθ -y sinθ  y’ = xsinθ+ ycosθ  or in matrix form:  P' = R • P,  R-rotation matrix.    **4. Shear:**  1. Shear is the translation along an axis by an amount that increases linearly with another axis (Y). It produces shape distortions as if objects were composed of layers that are caused to slide over each other.  2. Shear transformations are very useful in creating italic letters and slanted letters from regular  letters.  3. Shear transformation changes the shape of the object to a slant position.    4. Shear transformation is of 2 types:  a. X-shear: changing x-coordinate value and keeping y constant  x’=x+shx\*y  y’=y  b. Y-shear: changing y coordinates value and keeping x constant  x’=x  y’=y+shy\*x  shx and shy are shear factors along x and y-axis |

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| **Input** |
| Enter an object of any shape for transformation |

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| **Output** |
| Output object should undergo above mention transformations and display the transformed Object |

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| **Lab. Based FAQ** |
| 1. What is homogeneous co-ordinate system |

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| **Practice Assignment** |
| 1. Draw a house and perform all the above transformations. |