

**M.Sc. (MATHEMATICS WITH APPLICATIONS
IN COMPUTER SCIENCE)**

M.Sc. (MACS)

Term-End Examination

December, 2016

00294

MMTE-004 : COMPUTER GRAPHICS

Time : 2 hours

Maximum Marks : 25

(Weightage : 50%)

Note : *Question no. 1 is compulsory. Attempt any three questions out of questions no. 2 to 5. Use of calculator is not allowed.*

1. State whether the following statements are *True* or *False*. Justify your answers. $5 \times 2 = 10$
- (a) The height of the resized image 1024×768 to one that is 640 pixels wide with the same aspect ratio is 480.
- (b) The Cohen-Sutherland algorithm fails to clip a line if it is vertical and partly lying within the window.
- (c) If R is a rotation matrix by an angle θ about the origin, then $R - \theta = R_{\theta} R_{\theta}^{-1}$.

- (d) A triangle cannot be mapped to any arbitrary triangle using scaling transformation.
- (e) There can be only one principal vanishing point in a projected image.
2. (a) Use Bresenham's algorithm for scan converting a line from pixel coordinate (1, 1) to pixel coordinate (8, 5). Also plot the line. 3
- (b) Transform the scene in the world coordinate system to the viewing coordinate system with the view point at (2, 2, 2). The view plane normal vector is (-1, -1, -1) and the view up vector is (0, 1, 0). 2
3. (a) Find the transformation matrix that reduces the square ABCD, whose centre is at (2, 2), to half its size with centre still remaining at (2, 2). The coordinates of square ABCD are A(0, 0), B(0, 4), C(4, 4) and D(4, 0). Find the coordinates of the new square. 3
- (b) Consider a rectangle with vertices as (0, 0), (1, 0), (1, 1), (0, 1). Plot the output after executing the following code segment on the given rectangle : 2
- ```

glTranslate (- 0.5, - 0.5, 0)
glRotate (45°, 0.0, 0.0, 1.0)
glScaled (2, 2, 1)

```

4. Suppose R be the window which has its lower left corner at  $(-3, 1)$  and upper right corner at  $(2, 6)$ . For each of the following line segments, state whether it is visible, invisible or partially visible :

- (a)  $(-4, 2)$  to  $(-1, 7)$
- (b)  $(-1, 5)$  to  $(3, 8)$
- (c)  $(-2, 3)$  to  $(1, 2)$
- (d)  $(1, -2)$  to  $(3, 3)$
- (e)  $(-4, 7)$  to  $(-2, 10)$

If the line segment is partially visible, find the points of intersection with the window.

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5. Plot an ellipse, with centre at the origin having semi-major axis of 4 units and semi-minor axis of 3 units, using midpoint ellipse algorithm. Assume the initial point to be  $(0, 3)$ .

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