

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

**M.Sc. (MACS)**

00997

**Term-End Examination**

**June, 2014**

**MMTE-004 : COMPUTER GRAPHICS**

*Time : 2 hours*

*Maximum Marks : 25*

*(Weightage 50%)*

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

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1. State whether the following statements are *true* or *false*. Justify your answer. 10
- (a) The refresh rate of a  $512 \times 512$  frame buffer is approximately 21 frames/second, if the access time for each pixel is 200 nanoseconds.
- (b) 2-D rotations about the origin are non-commutative.
- (c) If a polygon lies on a plane  
 $Ax + By + Cz + D = 0$ , then  $N = (A, B, C)$  is normal to that plane.

(d) The matrix  $\begin{bmatrix} d & 0 & 0 & 0 \\ 0 & d & 0 & 0 \\ 0 & 0 & d & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$  represents

the perspective projection matrix on the plane  $z = d$ , where the centre of projection is  $(0, 0, 0)$ .

- (e) A cubic Bezier curve cannot be drawn if the control points are located at the vertices of a rectangle.
2. (a) Plot a circle at  $(5, 5)$  having a radius of 5 units using midpoint circle algorithm. 3
- (b) Use the Cohen Sutherland algorithm to clip the line  $P_1(70, 20)$  and  $P_2(100, 10)$  against a window with lower left hand corner  $(50, 10)$  and upper right hand corner  $(80, 40)$ . 2
3. (a) The reflection along the line  $y = x$  is equivalent to the reflection along the x-axis followed by counter clockwise rotation by an angle of  $\theta$  degrees. Find the value of  $\theta$ . 3
- (b) Find a matrix for parallel projection onto the plane  $3x + y + 4z + 1 = 0$  when an orthographic projection is used. 2

4. (a) Write the output obtained from each of the following OpenGL statements :

(i) `glMatrixMode (GL - Projection)`

`glLoadIdentity( )`

(ii) `glViewport (0, 0, 2, 2)`

(iii) `glutInitDisplayMode`  
`(GLUT_SINGLE/GLUT_RGB)`

Also draw the output obtained after executing the statements (i) to (iii). 2

(b) Plot the Bezier curve of order 3 with polygon vertices A(1, 1), B(2, 3), C(4, 3) and D(6, 4). 3

5. (a) Find out a window-to-viewport transformation that transforms a rectangular window with corners (1, 1), (3, 1), (3, 2), (1, 2) to another window with corners (0, 0), (2, 0), (1, 1), (3, 1). Also write a C-function that will perform this transformation using OpenGL transformation functions. 3

(b) Show that the  $2 \times 2$  matrix

$$T = \begin{bmatrix} \frac{1-t^2}{1+t^2} & \frac{2t}{1+t^2} \\ \frac{-2t}{1+t^2} & \frac{1-t^2}{1+t^2} \end{bmatrix}$$

represents pure rotation. 2