Ref. No.: Ex/CSE/MCA/T/222A/2018

M.C.A. Second Year Second Semester Examination 2018

COMPUTER GRAPHICS

Time: 3 hours. Full Marks: 100

Answer question no.1 and any 4 from the rest.
All parts of a question should be answered together.

1. a) Define symmetrical DDA and simple DDA in the context of drawing straight lines. **3**

   b) What is the significance of the octant dividing point in mid-point ellipse generation algorithm? How is that point located? **3**

   c) What is homogeneous co-ordinate system? How is it useful in geometric transformations? **3**

   d) Derive transformation matrix in homogeneous co-ordinate system to scale a graphic object keeping one of its vertices fixed. **3**

   e) Draw a comparison between straight line clipping and polygon clipping. **3**

   f) What is a segment table? State its usefulness in a graphic system. **3**

   g) Write down the equation of straight line in parametric form. **2**

2. a) Describe Bresenham's line drawing algorithm. How is the algorithm modified to avoid floating point division? **8**

   b) List the pixels selected by Mid-point circle drawing algorithm for drawing an arc from 45^0 to 135^0 of circle of radius 9 pixel units and centered at (9,6). **12**

3. a) Describe Active Edge List approach for generation of solid areas. **10**

   b) What are its drawbacks? **2**

   c) List the pixels selected by Edge Fill algorithm to fill a closed polygon ABCDEA with vertices A(1,1), B(9,3), C(9,6), D(6,3), and E(1,8). Describe each step clearly. **8**

[Turn over

4. a) An arbitrary affine transform of the form

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix}$$

is applied on the vertices of a quadrilateral ABCD with A(0,0), B(1,0), C(1,1) and D(0,1). This transformation results into another quadrilateral A'B'C'D' with A'(0,0), B'(3/2, 1/2), C'(2,2), and D'(1/2, 3/2). Draw both the quadrilaterals and also find 'a', 'b', 'c', and 'd'. **10**

b) Prove that a triangle remains a triangle after application of any arbitrary affine transformation on its vertices. **10**

5. a) Derive the transformation matrix for rotation about any arbitrary line in 3D space. Explain each step clearly. **12**

b) How are the codes assigned to the end-points of a line by line clipping algorithms? **4**

c) State the Visibility algorithm. Explain it with examples. **4**

6. a) Discuss with a simple example how the control points affect the overall shape of the curve. **5**

b) Define the term Blending function in the context of curve fitting. **3**

c) Write down the Blending functions for Bezier curve and surface. **4**

d) Derive the shading model for a point light source. Effect of ambient light and distance of the observer should be taken into account. **8**

7. a) In what way polygon clipping is different from line clipping? **4**

b) Describe Sutherland- Hodgeman algorithm for polygon clipping. **10**

c) Discuss flat shading. What are its drawbacks? **4+2**

8. Write short notes on any TWO. **2x10**

a) Seed fill algorithm.

b) Functional representation vs. parametric representation of curves and surfaces.

c) Parallel and perspective projections
