No. of Printed Pages : 3 **MMTE-004**

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

M.Sc. (MACS)

Term-End Examination

December, 2011

MMTE-004 : COMPUTER GRAPHICS

Time : 1½ hours *Maximum Marks : 25*

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

1. State whether the following statements are ***true*** or ***false***. Justify your answer. **2x5=10**

(a) The time taken to load 2560×2048 frame buffer at 12 bits per pixel and transfer rate of 10,000 bits per second is 1 hour.

(b) Uniform scaling and rotation form a commutative pair of operations.

(c) Outline fonts require more storage as compared to bitmap fonts.

(d) In homogeneous representation, 2D image can be represented by 2×2 matrix to make easy matrix computations.

(e) Image aspect ratio is same as its resolution.

2. (a) Explain the steps involve in Cohen Sutherland algorithm of line clipping. Find the visible portion of the line P(40, 80), Q (120, 30) inside the window ABCD where A (20, 20), B(60, 20), C (60, 40) and D (20, 40). **3**

(b) A unit square is transformed by a 2×2 transformation matrix. The resulting position vectors are : **2**

$$\begin{bmatrix} 0 & 2 & 8 & 6 \\ 0 & 3 & 4 & 1 \end{bmatrix}$$

Find the transformation matrix.

3. (a) Explain the midpoint circle algorithm and demonstrate it for a circle of radius $r=10$ with centre at the origin, upto three iterations. **2**

(b) Find an angle θ so that a 2D reflection through x-axis followed by 2D reflection through the line $y = -x$ is equivalent to only rotation about the origin by an angle θ. **3**

4. (a) Locate the new position of a triangle with vertices (1, 1), (4, 1), (4, 3) after rotation by 45° in the clockwise direction about (4, 3). **2**

(b) Suppose there is a rectangle ABCD where A(1, 1), B(1, 1), C(4, 4), D (1, 4) and the window coordinates are (2, 2), (5, 2), (5, 5) and (2, 5) and the given view port location is (0.5, 0), (1, 0), (1, 0.5) and (0.5, 0.5). Calculate the viewing transformation matrix. **3**

5. (a) Let $BEZ_{k\,,\,n}$ be k^{th} Bernstein polynomial defined by : 3

$BEZ_{k,n}(u) = C(n\,,\,k)\,u^k\,(1-U)^{n-R}$ where $C(n, k)$ are binomial coefficients defined as

$C(n, k) = \dfrac{n!}{k!\,(n-k)!}$ and $BEZ_{k,\,n}(u) \equiv 0$ for

$k > n$ or $k < 0$.

Prove that :

(i) $BEZ_{k,\,n}(u) = (1-u)\,BEZ_{k,\,n-1}(u) + u\,BEZ_{k-1,\,n-1}(u),\ n > k \leq 1.$

(ii) $\sum\limits_{k=0}^{n} BEZ_{k,n}(u) \equiv 1.$

(b) Differentiate between parallel and perspective projection. Give at least two differences. 2