Code: AC60/AT60　　　　　**Subject: COMPUTER GRAPH...**

AMIETE – CS/IT

Time: 3 Hours　　　　　| **DECEMBER 2012** |　　　　Max. Marks: 10...

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1　　**Choose the correct or the best alternative in the following:**　　　　　(2×10)

　　a. The parametric form of a line segment RT (line going from R to T) is
　　　$P_x (t) = 40 - 30\, t$
　　　$P_y (t) = 60 - 40\, t$
　　　The coordinates of R and T are
　　　(A) R(40,60), T(– 30, – 40)　　　**(B)** R(40,60), T(30, 40)
　　　(C) R(10,20), T(40,60)　　　　**(D)** R(40,60), T(10,20)

　　b. Shiny objects appear more realistic when the shading used is

　　　(A) Gourad Shading　　　　**(B)** Flat Shading
　　　(C) Phong Shading　　　　**(D)** False shading

　　c.　Indicate the most correct statement about Bezier curves

　　　(A) It always needs 4 control points.
　　　(B) The curve always stays inside the polygon formed by joining the points
　　　(C) Some curves do not pass through any of the control points.
　　　(D) Any two Bezier curves will join smoothly.

　　d. Which one of the following is not used for antialiasing?

　　　(A) prefiltering　　　　**(B)** coherent filtering
　　　(C) supersampling　　　　**(D)** postfiltering

　　e. A ray falls along direction D and projects a point P on a projection plane having normal vector N. An axonometric view will be generated when

　　　(A) N is not parallel to any of the principal axis
　　　(B) N is parallel to the X axis
　　　(C) D is not parallel to N
　　　(D) N is along the direction (1,1,1)

f. A mesh is _____ if the line connecting any two points within the object ...
    wholly inside the object.

   (A) connected   **(B)** simple
   (C) convex   **(D)** planar

g. The following transformation matrix represent

$$\begin{bmatrix} 1 & 0.707 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

   (A) rotation   **(B)** translation
   (C) shear   **(D)** scaling

h. Anticlockwise rotation of B^{o} about Y axis in 3D coordinate system is given by

$$\begin{bmatrix} X' \\ Y' \\ 1 \end{bmatrix} = [T] \begin{bmatrix} X \\ Y \\ 1 \end{bmatrix}$$

   Which one of the following is the correct T matrix?
   c stands for cos B and s stands for sin B.

(A) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & c & -s & 0 \\ 0 & s & c & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ **(B)** $\begin{bmatrix} c & 0 & s & 0 \\ 0 & 1 & 0 & 0 \\ -s & 0 & c & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} c & 0 & -s & 0 \\ 0 & 1 & 0 & 0 \\ s & 0 & c & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ **(D)** $\begin{bmatrix} c & 0 & s & 0 \\ 0 & 1 & 0 & 0 \\ s & 0 & -c & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

i. An isometric view is obtained when

   (A) the camera is pointing directly at one of the planes of the object.
   (B) the angles between the projections of the principal axes are equal.
   (C) the object is rotated by equal angles along the 3 principal axes.
   (D) the projection plane is parallel to one of the planes of the object.

j. Pick the correct alternative in the context of polygon meshes

   (A) The vertex list contains orientation information and face list contains topological information.
   (B) The normal list contains orientation information and the vertex list contains geometric information.

(C) The face list contains the geometric information and the vertex list contains topological information.

(D) The face list contains the topological information and the normal list contains orientation information.

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Using the outcodes of the end points of the line X(–20,15) - Y(20,50), examine whether the line is trivial accept, trivial reject or partially visible against the clipping window A(0,0), B(40,0), C(40,30), D(0,30). **(8)**

   b. Using Cyrus Beck algorithm find out if the line P1(15,25)- P2(35,10) gets clipped against the window S(0,20), T(0,0), Q(30,0), R(30,20). If it gets clipped then find the coordinates of the points where the line gets clipped. Construct the Cyrus beck table (for all the edges of the window) and show all the calculations. **(8)**

Q.3 a. Explain how Sierpinski Gasket is drawn. **(8)**

   b. Describe the parametric form of an ellipse with major axis given by (20,0)-(80,0) and minor axis given by (50,20) - (50, – 20). Find the coordinates of the left focus of the ellipse. Show open GL steps to plot this ellipse on the screen.

   (8)

Q.4 a. Explain the working of any two graphic display devices. Give their advantages and limitations. **(6)**

   b. Explain various types of pictures created in computer graphics. **(5)**

   c. Explain graphics input primitives and devices. **(5)**

Q.5 a. Given 4 control points P1(0,0), P2(20,60), P3(40,60), P4(60,60), draw the rough shape of the cubic Bezier curve. Work out the starting slope of the curve and the highest point on the curve. **(8)**

   b. Explain affine invariance and convex hull properties of Bezier curves. **(8)**

Q.6 a. Explain the following shading models and give their respective parametric equations
   (i) Gourand shading   (ii) Phong shading **(8)**

   b. Consider light falling on a polished surface with normal m from a single point light source. Develop the shading model involving both diffuse and specular reflections, given that the line along which the object is being viewed is making an angle Φ with the reflection vector. **(8)**

Code: AC60/AT60   **Subject: COMPUTER GRAPH**

Q.7 a. What is axonometric projection? Briefly describe its various classes.   **(6)**

b. Derive the projection matrix to obtain a perspective view using the homogeneous coordinate system to represent a point PX, PY, PZ with the eye at the origin.   **(5)**

c. A tetrahedron is specified by the vertices (0,0,0), (1,0,0), (0,1,0), and (0,0,1). Indicate the necessary data structure to represent the object, and steps to create and draw the mesh object using openGL.   **(5)**

Q.8 a. Consider the problem of filling up a polygon G(10,25), H(20,40), I(40,5), J(60,5), B(100,30), C(80,70), D(60,70), F(10,50), G(10,25). This polygon has a hole described by another polygon P(55,45), L(65, 55), M(75,55), N(70,45), P(55,45). Describe an algorithm to fill this polygon by utilizing properties of edge coherence.   **(8)**

b. Explain various anti-aliasing techniques.   **(4)**

c. Explain how pixmaps are manipulated and combined in raster displays.   **(4)**

Q.9 a. Consider a 2D triangle B(5,10), A(20, 20), C(30,5). Work out the transformation matrix to represent 60^0 clockwise rotation of the   point A about the point C. The new point A′ is related to old point A through the transformation:

$$\begin{bmatrix} x' & y' & 1 \end{bmatrix} = \begin{bmatrix} x & y & 1 \end{bmatrix}^T \qquad \textbf{(8)}$$

b. Write notes on:-
(i) 2D affine transformation.   (ii) 3D affine transformations
Give examples to illustrate.   **(8)**