ROLL NO. _____

ALCCS – OLD SCHEME

Code: CS40 **Subject: COMPUTER GRAPHICS**
Time: 3 Hours **Max. Marks: 100**

AUGUST 2011

NOTE:

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
- **Parts of a question should be answered at the same place.**
- **All calculations should be up to three places of decimals.**

Q.1 a. What is the difference between perspective projection and parallel projection?

b. Describe the operations for CSG modeling.

c. Consider a clipping window A(0,0), B(30,0), C(30,20), D(0,20). Using the outcodes of the end points of the line X(–10,30) – Y(35,8), show that the line is partially visible.

d. Explain briefly the floating Horizon method for hidden surface removal.

e. One Bezier curve is specified through control points A,B,C,D and the other Bezier curve is specified through P,Q,R,S. What restrictions must be specified on the choice of the points such that the two curves join smoothly?

f. Use an example to show how the fractal dimension is calculated for a self similar fractal.

g. What is the main difference between Gouraud shading with Phong shading methods? **(7 × 4)**

Q.2 a. Develop the illumination model which takes into account both diffuse reflection as well as specular reflection for an object lying at a distance of D units from a unit light source. **(6)**

b. Light falls along the z axis on a 3D planar surface with unit normal along $N(n_x , n_y , n_z)$. Work out the components of the Reflection vector R. **(6)**

c. Show how a cylinder and a cone can be constructed using the method of swept solids. The 3D coordinates of the centre of the base of the cylinder is (30,0,30) and that of the centre of the base of the cone is (100,0,30). Both have base diameter of 40 and height 100. **(6)**

Q.3 a. Consider a clipping window A(0,0), B(30,0), C(30,20), D(0, 20). Use Cyrus Beck algorithm to determine the portion of line P(25,40) – Q(50,10) clipped by this window. Make the complete Cyrus beck table and show all calculations. **(10)**

b. Explain briefly the Z-Buffer method for hidden surface removal. Show how depths are calculated for a planar Polygon Ax+By+Cz+D= 0 whose left edge has slope m.**(8)**

Q.4 a. Describe the Scan Line Seed fill algorithm to generate solid area on the screen. **(8)**

b. A box is 100 cm long, 50 cm wide and 50 cm high. It is lying with one of its corners lying at the origin of 3D axes, with its 3 edges touching the 3 axes. Work out the necessary rotations required so that an isometric view of the object can be viewed on the z=0 plane. **(10)**

Q.5 a. An animation sequence is to be developed to show a car accelerating from stationary position and then moving with constant speed. Show how the accelerations can be simulated for this purpose? **(8)**

b. Develop the Bresenham's circle generation algorithm to draw an octant of the circle (one eighth of a circle) with centre (0,0) and radius R. The octant starts from the point (O,R) and lies in the first quadrant. **(10)**

Q.6 a. Work out the transformation matrix to obtain mirror reflection of a point (X,Y) about a line passing through the points (0,20) and (20,0). Use this matrix to obtain the coordinates of the reflected points of a triangle P(20,20), Q(15,15), R(20,30). **(10)**

b. The characteristic basis matrix for a periodic cubic B-spline curve is given by

$$\frac{1}{6}\begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 0 & 3 & 0 \\ 1 & 4 & 1 & 0 \end{bmatrix}$$

Suppose a B-spline curve is drawn with control points A,B,C,D and another B-spline curve is drawn with control points B,C,D,E. Show that the two curves join smoothly (their first derivatives are same at the joining point). **(8)**

Q.7 a. Describe the transformation matrix to obtain the top view and the right side view of an object on the z = 0 plane. **(6)**

b. Given 4 control points P,Q,R and S, derive an expression for obtaining points on a Bezier curve. Show that the curve starts from point P and that the ending slope of the line is decided by the line RS. **(8)**

c. Draw a rough sketch of the cubic Bezier curve for the control points A(30,0), B(0,0), C(50, –10), D(50, -40). **(4)**