

## C10-R3: COMPUTER GRAPHICS & ANIMATION

### NOTE:

1. Answer question 1 and any FOUR questions from 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

**Time: 3 Hours**

**Total Marks: 100**

1.
  - a) Describe in qualitative terms the perspective and parallel viewing models, and the classes of visual task for which each is appropriate.
  - b) Defocusing the beam of a CRT is sometimes called “the poor man’s antialiasing.” Can you explain why?
  - c) Illustrate the key differences between Flat shading, Gouraud shading and Phong shading of polygons?
  - d) Outline the key ideas behind the radiosity equation for rendering. Radiosity is most useful for what kinds of scenes?
  - e) Describe a problem with using linear interpolation between keyframes. Describe a problem with using interpolating splines between keyframes.
  - f) Why is it easier to locate hidden surfaces when parallel projection is used?
  - g) What is the basic difference between dynamics and kinematics? What is the basic difference between forward kinematics and inverse kinematics?

**(7x4)**

2.
  - a) Distinguish between parametric space and range space for parametric curves.
  - b) How can a B-spline curve be changed into a Bezier curve by adjusting the knot positions? What happens to the continuity of the curve in this case?
  - c) Why does a point of inflection in a curve cause a problem if a generalised cylinder is being built around the curve?

**(6+6+6)**

3.
  - a) Describe the Z-buffer algorithm. For what type of scenes Z-buffer does not perform well? What effects are difficult to implement with Z-buffer? Explain why large difference between the far and near distances in the projection transformation will have a negative effect on Z-buffer performance.
  - b) Describe, how hidden surface removal and projection are integrated into the ray-tracing process.

**(10+8)**

4.
  - a) Describe the principles of Constructive Solid Geometry (CSG), when used as a method of modelling.
  - b) What is a mesh model and state briefly one advantage and one disadvantage of its use for surface modelling?
  - c) Give the Phong illumination model including ambient, diffuse and specular components. What effects are lost in Phong illumination by putting the light source and the viewer infinitely far away from the scene?

**(6+6+6)**

- 5.**
- a) Using the method of “similar triangles”, derive the matrix in 3D homogenous coordinates that represents a perspective projection.
  - b) A clipping window is given by  $P_0(10,10)$ ,  $P_1(20,10)$ ,  $P_2(25,15)$ ,  $P_3(20,20)$ ,  $P_4(10,15)$  and  $P_5 = P_0$ . Using Cyrus-Beck algorithm, clip the line AB where A is (0,0) and B is (30,25).  
**(10+8)**

- 6.**
- a) Describe flocking system technique for animation.
  - b) Briefly describe the following concepts:
    - i) rastreing/rasterization
    - ii) ambient light
- (10+8)**

- 7.**
- a) Hierarchical articulated objects are often found in computer animation. Describe, how a hierarchical articulated object can be represented internally by a computer animation system. What transformation information is stored in the hierarchical representation?
  - b) How many types of Boolean operations can be performed on the 3D objects represented by Octrees.
  - c) Describe the path animation technique and give an algorithm to implement path animation. Give an example of when this technique will be used by an animator.  
**(6+6+6)**