

AML710 Computer Aided Design

Major Examination Semester II– Session 2006-07

Time: 2 hrs

Marks: 60

Note: Answer all questions. There is a choice between Q.No 6 and 7.

1. a) Find the general form of the transformation matrix for rotation about a point P(p,q)
- b) Is simultaneous shearing the same as shearing along each direction in sequence?

Give reason.

- c) The isometric projection matrix is given below:

$$T_{iso} = \begin{bmatrix} \cos \phi & \sin \phi \sin \theta & 0 & 0 \\ 0 & \cos \theta & 0 & 0 \\ \sin \phi & -\cos \phi \sin \theta & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

where ϕ and θ are the angles of rotations about y-axis and x-axis respectively. Find the angle that the projected x-axis makes with the horizontal.

(5+4+4)

2. a) A Bezier curve is given by

$$P(t) = \sum_{i=0}^n B_i J_{n,i}(t) \quad \text{where} \quad J_{n,i}(t) = \frac{n!}{i!(n-i)!} t^i (1-t)^{n-i}$$

Consider a 4 point control polygon. Write the blending functions and their derivatives. Evaluate the derivative of the curve at $t=0$ and at $t=1$. Comment on your answer.

- b) In the case of Coon's bicubic surface, bring out precisely the effect of tangent vectors and twist vectors.

(6+5)

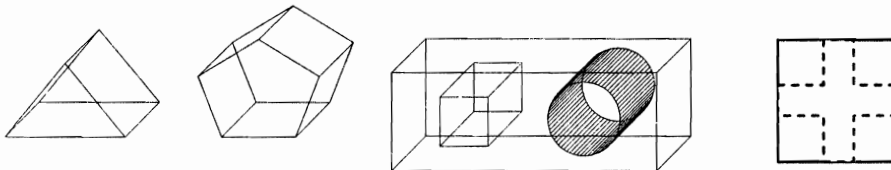


Fig. 1 (i) Wedge (ii) Pentagonal prism (iii) Block with 2 through holes (iv) Cube with 2 Perpendicular holes of square section

3. a) Write different forms of Euler-Poincare law with definition of its elements.
- b) Validate the solids in Fig. 1 using Euler-Poincare law

(5+4)

4. a) Explain the statement: $W = iS \cup bS \cup cS$
- b) Mention three types of solid modeling algorithms

(3+3)

5. a) Three point sets of E^2 define three valid polygonal solids S_1 , S_2 and S_3 with their respective boundary sets (vertices) given as

$$bS_1 = [(2,2), (5,2), (5,5), (2,5)] \quad bS_2 = [(3,3), (7,3), (7,6), (3,6)]$$

$$bS_3 = [(4,1), (6,1), (6,4), (4,4)]$$

Find $S_1 \cup S_2 \cup S_3$, $S_1 \cap S_2 \cap S_3$ and $S_1 - S_2 - S_3$

- b) What is winged edge data structure? Explain how it is used in solid modeling.

(6+3)

6. a) Define a half-space. Give two examples with their equations.
b) Define a binary tree. Illustrate different types of tree traversals.
c) Write the answers for the following set operations with usual notations:

$$c(P \cup Q) = ?$$

$$P \cap cP = ?$$

$$P \cup cP = ?$$

(4+5+3)

OR

7. a) Discuss the Cohen-Sutherland end point coding algorithm.
b) Write the salient features of Floating horizon algorithm.

(6+6)
