

Time: 1 hr

Marks: 25

Note: Answer all the questions. In Q1 some answers may not be unique.

1. Write only the most appropriate answers which fill the blanks in the following statements

- a) The cubic Hermite curve has _____ algebraic coefficients and _____ degrees of freedom while cubic Hermite patch has _____ algebraic coefficients and _____ degrees of freedom.
- b) The condition for the smoothness of the surface is _____
- c) _____ is a common example of a smooth surface with one singular point.
- d) For a cubic spline, relaxed, cyclic and anti-cyclic end conditions respectively are _____ and _____.
- e) The self intersecting bicubic surface results when _____ exceeds critical value.
- f) Development of the curved surface of cylinder yields _____ while that of a frustum of a cone is _____.
- g) Every isoparametric curve on the bilinear surface is a _____ while the surface is _____.
- h) The equation $x = \frac{h-z}{h} r \cos(\alpha z)$; $y = \frac{h-z}{h} r \sin(\alpha z)$; $z = z$ $0 \leq z \leq h$ represents _____ curve and h is its _____.
- i) In B-splines, the set of subinterval endpoints are called _____.
- j) A rational curve is the _____ of a non-rational curve from _____ space to _____ space.

(0.5×20 blanks)

2. a) What is the algebraic form of the cubic Hermite curve? Obtain the geometric form from it with necessary boundary conditions.
- b) Given a cubic parabola $x = t$; $y = t^2$; $z = t^3$ $0 \leq t \leq 1$, sketch its component curves. How can the component curves tell the difference between plane and space curves?

(4+2)

3. Consider a line segment with end points (1,1,0) and (6,2,0). Generate a conical surface of revolution of the form $Q(t, \phi) = x(t)\hat{i} + y(t)\cos\phi\hat{j} + y(t)\sin\phi\hat{k}$; $0 \leq t \leq 1$; $0 \leq \phi \leq 2\pi$. Determine a point on the surface at $Q(t, \phi) = (0.5, \pi/3)$. Also, find the surface normal at the same point.

(4)

4. a) Discuss the effect of tangent vector magnitude on the Coon's bicubic patch. What is the significance of twist vectors?
- b) How many types of knot vectors are used in B-spline representation? Write each type of knot vectors for the case when $n+1=4$ and $k=3, 4$.

(2+3)