Code : 021730

B.Tech 7th Semester Exam., 2020

COMPUTER-AIDED DESIGN AND MANUFACTURING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

(v) Assume additional data suitably, if required.

1. Answer any *seven* of the following questions in brief : 2×7=14

(a) Specify the various input hardware devices used in a CAD system.

(b) Specify the limitations of a wireframe model.

(c) Explain auxiliary statements in NC part programming.

(d) Specify the benefits of use of computer in the drafting process as compared to the manual techniques.

(e) Specify the advantages of CNC over conventional NC.

(f) Why do we prefer the cubic polynomials for representing various parametric curves?

(g) Explain the effects of mesh size on the results obtained using the finite element method.

(h) Explain model coordinate system (MCS) with an example.

(i) Specify the transformation matrix for 2D rotation about any arbitrary point.

(j) Under what condition a cubic Bezier curve degenerates to a straight line connecting points P_0 and P_3?

2. *(a)* A cubic parametric curve is defined by the equation

$$P(u) = a_3u^3 + a_2u^2 + a_1u + a_0,\ 0 \le u \le 1$$

where a_3, a_2, a_1 and a_0 are the algebraic coefficients. Assuming these coefficients are known, determine the four control points that define an identical cubic Bezier curve. 9

(b) Describe the different ways of modifying a given Bezier curve with examples. 5

3. *(a)* Derive the expressions of blending functions of a cubic Hermite curve. The geometric conditions used are end-point position vectors and end-point tangent vectors. 7

(b) Find the parametric equation of a cubic Hermite curve that passes through the end-points $P_0(1, 5)$, $P_1(3, 2)$ and whose end-point tangent vectors are $P_0^u(2, 0)$, $P_1^u(-4, -2)$. 7

4. (a) Determine the five, third-order B-spline blending functions

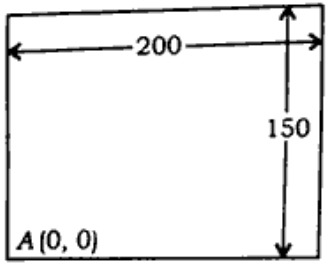
$$N_{i,3}(u),\ i = 1, 2, 3, 4, 5$$

with the knot vector

$$T = [0\ 0\ 0\ 2\ 2\ 3\ 3\ 3]$$ 10

(b) A B-spline curve has the property that it can be locally modified without affecting the entire curve. Explain the reason for it with an example. 4

5. Write the NC part program for machining a rectangular contour of 200 mm × 150 mm size from a suitable blank of 5 mm thickness. The milling cutter has a diameter of 10 mm. The feed rate is 100 mm/min and rotation speed is 1000 r.p.m. Point A is to be considered as the origin and the cutting tool is initially located at (−20, −20) position. 14



6. (a) Describe different levels of automation with examples. 9

(b) Describe the various benefits of implementing product cycle automation. 5

7. A point $P(10, 10, 10)$ is required to be reflected through a plane represented by a triangle ABC with end-points $A(0, 0, 10)$, $B(10, 0, 0)$ and $C(0, 5, 0)$. Specify the standard transformations required to achieve the desired operation and determine each corresponding transformation matrix. 14

8. (a) What is an AGV system? Describe different types of navigation methods used in AGV systems. 10

(b) Describe the various benefits associated with the use of AGV systems in industry. 4

9. (a) What do you understand by DNC? Describe the different functions performed by the DNC computer with examples. 9

(b) Explain the application of CAD in the analysis using the finite element method. 5

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