Dr Rajesh Kumar (92) 2/12/2022 (E)

National Institute of Technology Hamirpur (H.P.)

B. Tech. End-Semester Examination, 2022

Branch	:	CAD/CAM	**Course Code**	:	ME-412
Semester	:	7th	**Time**	:	3 Hours
Course Name	:	Computer Aided Design	**Max. Marks**	:	50
Session & Time	:		**Date**	:	

NOTE: Attempt all questions which carry marks as indicated in the [ ]. If any data is missing assume it.

Q1. (a) A set of control points is given by P0 = (4, 4), P1 = (6, 8), P2 = (8, 9) and P3 = (10, 3). Compute the Bézier curve. Let the coordinate axes be moved to (2, 2) and then rotated by 30° counter-clockwise. What is the new Bezier curve? **[8]**

(b) Show that the following motion is a rotation **[4]**

$$x' = \frac{1}{6}x + \left(\frac{2}{\sqrt{6}} + \frac{1}{6}\right)y + \left(-\frac{1}{\sqrt{6}} + \frac{1}{3}\right)z,\ y' = \left(-\frac{2}{\sqrt{6}} + \frac{1}{6}\right)x + \frac{1}{6}y + \left(\frac{1}{\sqrt{6}} + \frac{1}{3}\right)z$$

$$z' = \left(\frac{1}{\sqrt{6}} + \frac{1}{3}\right)x + \left(-\frac{1}{\sqrt{6}} + \frac{1}{3}\right)y + \frac{2}{3}z$$

(c) For two triangular objects, S_1 {P_1 (0, 0, 1), P_2 (1, 0, 0), P_3 (0, 0, 0)} and S_2 {Q_1 (0, 0, 2), Q_2 (0, 2, 0), Q_3 (2, 0, 0)}, it is required that after assembly, point P_1 coincides with Q_1 and edge P_1P_2 lies on Q_1Q_3. Determine the transformations if S_1 is required to be in the same plane as S_2. **[10]**

Q2. (a) What is concatenated transformation? Find the reflection matrix of a point P(x, y) about y= mx+c. **[4]**

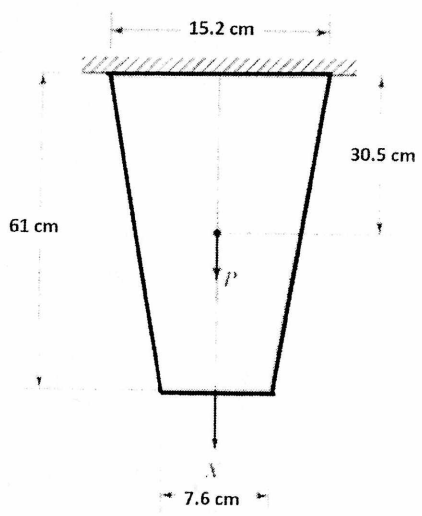
(b) What are plane stress and plane stress conditions? Give one example of each. **[5]**

(c) Explain the boundary representation scheme (B-Rep). **[4]**

Q3. a) Describe the Bresenham's algorithm for line generation in CAD. **[5]**

(b) Consider the thin steel plate as shown in figure. The plate is of uniform thickness t = 2.54 cm., Young's modulus E = 207 GPa, and weight density ρ= 7850 kg/m^3 . In addition to its self-weight, the plate is subjected to a point load P = 445 N at its midpoint. **[10]**

(a) Model the plate with two finite elements.



(b) Write down expressions for the element stiffness matrices and element body force vectors.

(d) Using the elimination approach, solve for the global displacement vector Q.

(e) Evaluate the stresses in each element.

(f) Determine the reaction force at the support.

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