

GUJARAT TECHNOLOGICAL UNIVERSITY
ME 1st SEMESTER– EXAMINATION – WINTER 2014

Subject Code: 2710802**Date:07/01/ 2015****Subject Name: Computer Aided Design****Time:****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Representation of points should be using column matrices.

- Q.1 (a)** Explain product life cycle in conventional and computer aided manufacturing environments. State various software tools used during this stage. How computer aided design is used for development of such tools? **07**
- (b)** A plane lying vertically perpendicular to XY-plane such that it passes through points (10, 0) and (0, 10) intersect at a line. List the steps to be followed before formulation of composite transformation matrix for reflection about a line $y = mx + b$. Derive reflection matrix using parameters slope (m) and intercept (b) in generalized form. Find the reflected coordinates of triangle ABC with coordinates A (50, 50), B (20, 40) and C (10, 70). **07**
- Q.2 (a)** What is a need of homogeneous transformations usage in computer graphics? What are the advantages of homogeneous coordinates? Represent translation, rotation and scaling matrices for 3D transformations in homogeneous form. **07**
- (b)** Derive a parametric equation for generating a straight line between two end points P_0 and P_1 using sketch. Calculate the coordinates of intermediate points for a straight line between points $P_0[18 \ 26 \ 0]$ and $P_1[33 \ 32 \ 0]$ using $u=0.2, 0.4, 0.6$ and 0.8 . **07**
- OR**
- (b)** Derive transformation matrix of right view for orthographic projections. **07**
- Q.3 (a)** Derive from fundamentals the parametric equation for a Bezier curve defined by 4 control points. Prove that: **07**
- i. The curve is tangent to the first and last segments of the characteristic polygon.
 - ii. The curve is symmetric with respect to the parameters u and $(1-u)$.
- (b)** Differentiate between analytic and synthetic surfaces. Write an equation of plane surface passing through three points P_0, P_1, P_2 in parametric form. If plane is passing through $P_0[1 \ -6 \ 4]$, $P_1[1 \ 2 \ 3]$ and $P_2[3 \ -1 \ 2]$. Find equation of plane passing through these points. Find point on this plane for parameters values $u = 0.5$ and $v = 0.5$. Determine also the normal of this plane at this point. **07**
- OR**
- Q.3 (a)** Develop the blending requirements between two consecutive segments of a Hermite cubic spline give three points P_0, P_1 and P_2 as well as tangents at points P_0 and P_2 . **07**
- A generalized parametric equation of Hermite Cubic spline is:
- $$P(u) = (2u^3 - 3u^2 + 1)P_0 + (-2u^3 + 3u^2)P_1 + (u^3 - 2u^2 + u)P_0' + (u^3 - u^2)P_1'$$
- $0 \leq u \leq 1$
- (b)** Consider a line segment with end points $P_1[2 \ 2 \ 0]$ and $P_2[8 \ 4 \ 0]$ lying in the xy-plane. Rotating the line about x-axis yields a conical surface. Determine the point on this surface at $u=0.5$ and $\theta = 60^\circ$ of rotation about x- **07**

axis CCW.

- Q.4 (a)** Explain the concept of three Boolean operations used in solid modeling. Give neat sketches showing effect of these operators on any two basic primitives. Distinguish between CSG and B-rep models. **07**
- (b)** Describe any seven features with neat sketch for feature based modeling supported by CAD software. **07**

OR

- Q.4 (a)** i) Differentiate between bottom up and top down assembly approach. **04**
ii) Explain briefly any three properties of a solid model. **03**
- (b)** Draw neat sketches of concentric, co-radial, equal, horizontal, merge points, mid-point, parallel, perpendicular constraints used in feature based modeling for before applying constraint and after applying constraint. **07**

- Q.5 (a)** Explain geometric property formulation for a) curve length for both open and close curve and b) Surface area (A_s) of a bounded surface. **07**
- (b)** List various data exchange formats used in high end CAD softwares. What is abbreviation of IGES? Describe various sections of IGES file format. **07**

OR

- Q.5 (a)** Explain mass property formulation of a solid a) centroid (r_c) and b) first moment of inertia of an object with respect to XY, XZ and YZ planes. **07**
- (b)** Describe Standard for the Exchange of Product Model Data (STEP) architecture using sketch. **07**
