## GUJARAT TECHNOLOGICAL UNIVERSITY ME SEMESTER – I (NEW) EXAMINATION – SUMMER 2017

# Subject Code: 2710802 Subject Name: Computer Aided Design Time:02:30 P.M. to 05:00 P.M.

**Total Marks: 70** 

### Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q-1 (a) Why are homogeneous coordinates preferred over Cartesian coordinates in carrying out transformations? Write matrices for translation, rotation about Y-axis and scaling for 3D space using homogeneous coordinates.
  - (b) Determine pixels to be plotted, when a line is drawn from the position A (0, 0) 07 to the position B (6, 2) using Bresenham's algorithm.
- Q.2 (a) State the reasons to design a product. Draw a flow chart of various phases of design process of product life cycle using CAD. Enlist applications of CAD in mechanical engineering.
  - (b) Develop the transformation matrix for visualization of right hand side view of a 3D model lying in right hand Cartesian coordinate system in XY-plane vertical. Explain steps followed with near sketches.

#### OR

(b) Given a point P=[80,40,20] and using the homogeneous representation, obtain 07 the coordinates
(i) Rotate point P about X axis by 45° followed by rotation about Z axis by 60°
(ii) Rotate point P about Z axis by 60° followed by rotation about X axis by 45°

What would you conclude from above results?

- Q.3 (a) Derive from fundamentals the parametric equation for the cubic spline in terms 07 of its two end points and their tangent vectors.
  - (b) Bezier curve is defined by four control points in sequence P<sub>0</sub> (4, 2), P<sub>1</sub> (6, 6), 07
     P<sub>2</sub> (10, 2) and P<sub>3</sub> (4, 2). Find the equation of the curve. Evaluate the Bezier function for u=0, 0.25, 0.5, 0.75 and 1.

#### OR

- Q.3 (a) Derive from fundamentals the parametric equation for a Bezier's curve defined by 4 control points. Prove that,
  (i) The curve is tangent to first and last segments of the characteristic polygon.
  (ii) The curve is symmetric with respect to the parameters u and (1-u).
  (b) Explain B-spline curve along with its properties.
- Q.4 (a) Explain the following surface entities:
   07

   (i) Rules surface
   (ii) Tabulated surface

   (iii) Surface of revolution
   (iv) Plane surface

   (b) Mustice surface
   State different graduation of a solid surface
  - (b) Mention various solid modelling schemes. State different properties of a solid 07 model.

Q.4 (a) What are the limitations of wire frame models of a solid? Explain B-rep and CSG techniques of solid modelling with suitable examples. Prepare edge list prism with triangular base.
(b) Generate the conical surface obtained by rotation of the line segment AB around 07 the z-axis with,

A = (3, 0, 3) and B = (10, 0, 10).

Also find coordinates of a point on a surface at u=0.5 and  $\phi = \pi/4$  radians.

- Q.5 (a) Derive curve length as a geometric property between two end points. 07
  - (b) Enlist various data exchange formats used in CAD software. State full form of IGES along with various sections used in IGES.

#### OR

- Q.5 (a) Explain features and feature entities in feature based modeling? What do you 07 mean by feature manipulations?
  - (b) Explain Bottom-up assembly modelling and Top-down assembly modelling 07 approach

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