Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015**

**Subject Code: 2710802** **Date: 01/01/2016**

**Subject Name: Computer Aided Design**

**Time:2:30 pm to 5:00 pm** **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)** Derive the equation of an ellipse whose major axis is inclined with an angle α relative to the X-axis and ellipse with center $P_c$ ($x_c$, $y_c$, $z_c$) and the lengths of half of major and minor axes are A and B respectively. **07**

**(b)** Mention the advantages of Bresenham's algorithm over DDA algorithm. Use Bresenham's line algorithm to rasterize a line from A(0, 0) to B(7, 6). **07**

**Q.2** **(a)** Draw a neat sketch and obtain parametric representation of a straight line with two end points $P_1$, $P_2$. Represent the line with end point coordinates $P_1$ (2, 0, 3) to $P_2$ (9, 0, 13) in parametric analytic form. **07**

**(b)** Compare conventional and computer aided design processes. Enlist various applications of CAD. **07**

**OR**

**(b)** Draw a diagram of a typical product life cycles. List various CAD/CAM tools used at each stage of design and manufacturing phase of product life cycle. **07**

**Q.3** **(a)** Write an equation of Bezier's curve with four control points. The coordinates of four control points relative to a current WCS are given by: **07**
$P_0$= [3 2 0], $P_1$= [3 3 0], $P_2$= [2 3 0] and $P_3$= [2 2 0]. Find the equation of the resulting Bezier curve. Also find points on the curve for u=0, 0.25, 0.5, 0.75 and 1.

**(b)** Explain and obtain the matrices for following orthographic projections as shown for figure 1, **07**
(i) Front view (ii) Top view

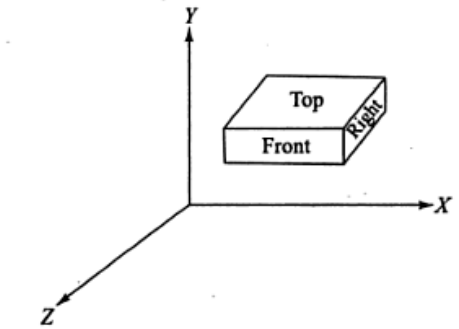


Figure 1 Model views relative to its MCS

**OR**

**Q.3** **(a)** Derive the equation of Hermite's cubic spline and represent in matrix form. Also write properties of this synthetic curve. **07**

**(b)** Derive a matrix of a perspective projection onto the $z_v$=0 plane when the centre of projection is placed on the $z_v$ axis at a distance d from the origin with a neat sketch. **07**

**Q.4** **(a)** Generate the conical surface obtained by rotation of the line segment AB around the z-axis with, **07**

A= (2, 0, 2) and B = (8, 0, 8).

Also find coordinates of a point on a surface at u=0.4 and $\phi=\pi/2$ radians.

**(b)** What is a basic difference between ruled surface and coons surface (coons patch)? Write an equations for coons patch with neat sketch. **07**

**OR**

**Q.4** **(a)** A cubic Bezier curve is defined by the control points: $P_0$ =[1,0,2], $P_1$ = [3,0,4], $P_2$ = [2,0,6], $P_3$ = [5,0,7]. Find the surface of revolution obtained by revolving the curve about the z-axis and calculate the point on the surface at u = 0.25, $\phi = \pi/6$ radians. **07**

**(b)** Differentiate between implicit and explicit surfaces. Mention various types of surfaces. Explain any one surface in detail. **07**

**Q.5** **(a)** Explain boundary representations in detail. Compare boundary representations (B-rep) with Constructive Solid Geometry (CSG). **07**

**(b)** Formulate the equation of the surface area $A_s$ of a bounded surface in form of **07**

$$A_s = \int_{v_1}^{v_2} \int_{u_1}^{u_2} \sqrt{(P_u \cdot P_u)(P_v \cdot P_v)}\,du\,dv$$

**OR**

**Q.5** **(a)** List various data exchange formats. Explain IGES data representations and its structure. **07**

**(b)** Formulate curve length as a geometric property between two end points. **07**

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