

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME - SEMESTER- I (OLD course) • EXAMINATION – SUMMER 2015**

**Subject Code: 710802****Date: 12/05/2015**

Subject Name: Computer Aided Machine Design

**Time: 10:30 am to 1:00 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) Draw a typical product life cycle. Explain various CAD tools used in design phase of a product life cycle. **07**
- (b) What is the difference between homogeneous coordinates and ordinary coordinates? What are the advantages of homogeneous coordinates? Represent translation, rotation and scaling matrices for 3D transformations in homogeneous form. **07**
- Q.2** (a) Determine the pixel locations for drawing line from  $P_1(10,5)$  to  $P_2(20,13)$  using Bresenham's algorithm. **07**
- (b) Given a point  $A [2 \ 5 \ -3 \ 1]^T$ , determine **07**
- a) Transformed point  $A'$ , if A is translated by  $d = 2\hat{i} + 3\hat{j} - 4\hat{k}$  and then rotated by  $30^\circ$  about Z axis.
  - b) The point A is rotated by  $30^\circ$  about Z axis followed by translation of  $d = 2\hat{i} + 3\hat{j} - 4\hat{k}$ .
  - c) Is point  $A'$  be same in cases of (a) and (b)? Why?

**OR**

- (b) Show sequence of transformation to be made to mirror any entity about the line with the equation  $y = mx + b$ . Prove that transformation matrix in 2D case for mirroring about arbitrary line is, **07**

$$M_L = \begin{bmatrix} \frac{1-m^2}{1+m^2} & \frac{2m}{1+m^2} & \frac{-2bm}{1+m^2} \\ \frac{2m}{1+m^2} & \frac{m^2-1}{1+m^2} & \frac{2b}{1+m^2} \\ 0 & 0 & 1 \end{bmatrix}$$

- Q.3** (a) Differentiate between Bezier and Cubic spline curve. Derive expression of Bezier's curve with five control points. **07**
- (b) Highlight difference between synthetic curves over analytic curves. Derive the expression of normal vector to a cubic spline curve at any of its points. **07**

**OR**

- Q.3** (a) For points  $P_0 = (1,2)$  and  $P_1 = (3,1)$  with corresponding slopes  $P_0' = (0.866, 0.5)$  and  $P_1' = (0.707, 0.707)$ , Formulate the equation of Hermite cubic spline. **07**
- (b) Explain ó Spline curve with its major advantages. What do you mean by variational diminishing property? **07**
- Q.4** (a) Describe rule surface, surface of revolution, tabulated cylinder in brief. **07**
- (b) Draw a flow chart and prepare a computer program for the design of single plate clutch using uniform wear theory. **07**

**OR**

- Q.4 (a)** Write a C program to design a helical spring with different ends. The output of the program should be spring parameters such as wire diameter, coil diameter, number of turns, free length, pitch etc. **07**
- (b)** Explain a) Constructive Solid Geometry and b) Sweeping **07**
- Q.5 (a)** Write primary, subsidiary and limit equations for the optimum design of a shaft subjected to twisting moment and bending moment. Get the material selection factor for minimum weight. **07**
- (b)** What do you mean by optimization? Give classifications of optimization. State any application of optimization in mechanical design with an example. **07**

**OR**

- Q.5 (a)** Explain constraint surfaces in a hypothetical 2D design space. Also explain objective function, design variables and design constraints citing examples. **07**
- (b)** Derive an equation of an ellipse in parametric form if the ellipse major axis is inclined with an angle  $\theta$  relative to X axis with neat sketch. **07**

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