Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 710802N **Date: 13/02/2012**
Subject Name: Computer Aided Machine Design
Time: 10.30 am – 01.00 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)** Show sequence of transformation to be made to mirror any entity about the line with the equation y = mx + b. **07**

(b) What is B-rep and CSG technique in solid modeling? Compare them. **07**

Q.2 **(a)** Explain various commonly used primitives for solid modeling and explain the Boolean operations. **07**

(b) Compare explicit and implicit non parametric representation of curve. Explain the parametric representation of a curve and its advantages over non-parametric representations with suitable example. **07**

OR

(b) Write a parametric equation of a circle having center (3, 3, 0) and radius of 3 units. Calculate the coordinates of points on a circle if it is divided into 8 parts. **07**

Q.3 **(a)** Write steps required to plot a line whose slop is between 45^0 & 90^0, using Bresenham's algorithm. **07**

(b) The vertices of a Bezier polygon are A_0 [2, 2], A_1 [3, 4], A_2 [3, 4] and A_3 [5, 4]. Determine 4 points on the Bezier curve. **07**

OR

Q.3 **(a)** What are the different continuity conditions? Explain with neat sketches. **07**

(b) Explain the characteristics of B-spline curve. **07**

Q.4 **(a)** Discuss objective function and constraints in optimization of mechanical engineering component design problem. **07**

(b) A thin walled spherical pressure vessel is to be designed for storing gas under pressure such that t<<D, where, t- wall thickness and D – mean diameter of the vessel. Design the diameter D for maximum gas storing capacity, the thickness t and optimum choice of material. **07**

The materials available are :-i) Aluminum alloy, ii) plain carbon steel, iii) cast steel, iv) low alloy steel

The following equations may be used in the optimization study:-

(1) $\sigma_t = PDK_t / 4t$

where, σ_t -permissible tensile stress for the material

K_t- theoretical stress concentration factor

P- Design pressure

(2) mass of vessel $M = \rho\pi D^2 t$

where, ρ- mass density of the material

The following limitations are specified:-

$M \leq M_{max}$ and $\sigma_t = \sigma_{ut} / F_s$

Where, σ_{ut} -ultimate tensile stress material &

Fs- factor of safety

OR

Q.4 **(a)** What is optimization? Describe classification of optimization. Give application of optimization in mechanical design. **07**

(b) A heat exchanger is to be designed for minimum cost. The design requirement indicated that 300 m of tube length in all be installed for achieving necessary heat transfer surface. **07**

The total cost of installation has been approximately as:-

(1) total cost of tubes = Rs. 24,500/-

(2) cost of shell- = Rs. 875 $D^{2.5}$ L

where, D- shell diameter and

L-length of each tube ≈ length of heat exchanger.

(3) Cost of floor space occupied by the heat exchanger =700DL

- The spacing of the tube is such that 20 tubes can be accommodated in cross-sectional area of 1 m^2 inside the shell. Determine the diameter D and length L of the heat exchanger to minimize costs.

Q.5 **(a)** Explain the techniques of generation of axisymmetric objects of surface modeling. **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.5 **(a)** Explain the following surface modeling techniques **07**

i) Coons patch ii) Tabulated surface

(b) What are features based modeling technique? What is the significance of this technique? List the examples of software which are incorporated this technique. **07**

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