

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: 710802N**Date: 26-12-2013****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 mark.

Q.1 (a) State and describe the functional areas of CAD in the field of engineering. **07**

(b) Write the full form of the following video display hardware: **07**

1. LCD 2. LED 3. OLED 4. DLP

What is ICG? Enlist various functions of typical CAD workstation.

Q.2 (a) What do you mean by scan conversion? State the three side effects of scan conversion. Draw a line from point (1, 6) to (11, 0) using DDA algorithm. **07**

(b) Perform a 60° of rotation of triangle with vertices A (2, 3), B (4, 5) and C (6, 7) (a) about origin and (b) about (-2,-2). State the need of homogeneous transformations in computer graphics. **07**

OR

(b) Differentiate between **07**

- a) Geometric and coordinate transformations
- b) Analytic and Synthetic curves.
- c) Raster scan and vector scan display

Q.3 (a) A Bezier curve is defined by four control points: (3, 0, 1), (4, 0, 4), (8, 0, 4) and (10, 0, 1). Find the equation of the curve. Find points on the curve for $u=0, 0.25, 0.5, 0.75$ and 1. What do you mean by variational diminishing property? **07**

(b) What is the relationship between $R_{\theta}, R_{-\theta}, R_{\theta}^{-1}$? Show with an example. **07**

OR

Q.3 (a) What do you mean by orthogonal transformation? State the properties of orthogonal matrix. Prove that the inverse of orthogonal transformation is orthogonal matrix. **07**

(b) State the properties of β -spline curves. Draw a relevant sketch representing convex hull property of β -spline curve for $k=4$ with minimum 8 vertices. **07**

Q.4 (a) Which are various schemes for solid model representations? Compare constructive solid geometry and boundary representations. **07**

(b) Write a C-program to design a helical spring with different ends conditions. The output of the program should be spring parameters such as wire diameter, coil diameter, number of turns, free length, pitch etc. **07**

OR

Q.4 (a) Write a C-program for design of a shaft subject to number of point loads in one plane and transmitting power from any one given point to some other point on shaft. Make your program self explanatory using comment statements. **07**

(b) What do you understand by parametric modeling and feature based modeling? List any three parametric modelers. What is parent-child relationship? **07**

- Q.5 (a)** In light weight equipment, a shaft is transmitting a torque of 1000 N-m and has a rigidity of 100 N-m/degree. Assume factor of safety 1.5 based on yield stress. Design shaft with minimum weight using Johnson's method. Find diameter and length, assume maximum shear stress theory of failure $\tau_{max} \leq \frac{0.5S_y}{FOS}$ **07**

Use following data for materials:

Material	Material Density (ρ) Kg/m ³	Yield Strength MPa	Shear Modulus GPa
Steel alloy	8500	130	80
Al. alloy	3000	50	26.7
Titanium alloy	4800	90	40
Magnesium alloy	2100	20	16

Formulae: $\frac{M_T}{J} = \frac{\tau_{max}}{r} = \frac{G\theta}{L} = \frac{M_T}{\theta} = K = \frac{GJ}{L}$

Where K = Torsional rigidity in N-m/radian

M_T = Torque rating in N-m

r = radius of shaft

L = length of shaft

S_y = Yield stress in N/m²

G = Modulus of rigidity in N/m

- (b)** Explain ruled surface and linear coons surface with neat sketch. **07**

OR

- Q.5 (a)** Write a generalized statement of an optimization problem. What do you mean by design variables, design vector, design space, design point and design constraints. **07**
- (b)** Explain surface of revolution. Write parametric equations for the following surfaces generated through surface of revolution: **07**
- 1) Sphere 2) Ellipsoid 3) Paraboloid 4) Hyperboloid
