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## C.U.SHAH UNIVERSITY

 Summer Examination-2017Subject Name : Computer Aided Design and Engineering

Subject Code : 4TE06CDE1
Semester : 6
Instructions:

Branch : B.Tech (Mechanical)

Time :2:30 To5:30 Marks :70
(1) Use of Programmable calculator \& any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Attempt the following questions:
a) Write the matrix of 3 D rotation with respect to z axis.
b) What is homogeneous coordinate representation?
c) Define scan conversion.
d) Write the name of any four softwares which are used for 3D modeling?
e) Write any two differences in between CSG and B-rep techniques.
f) What is surface modeling?
g) Define the synthetic curves.
h) What is Graphics Kernel System (GKS)?
i) What is mesh convergence ?
j) Define the nature of shape function.
k) Define the local coordinate system.
l) What is element connectivity?
m) Define optimization.
n) Write Lagrange expression.

## Attempt any four questions from $\mathbf{Q}-2$ to $\mathbf{Q - 8}$

## Q-2 Attempt all questions

a) Discuss Initial Graphics Exchange Specification (IGES) data exchange format.
b) Enlist the various methods of geometric modeling. Discuss wire frame modeling in detail.

## Q-3 Attempt all questions

a) Explain DDA algorithm for line generation with its limitations.
b) Using Bresenham's line algorithm, find the pixel positions along the line path between end points $(20,10)$ and $(30,18)$.

Q-4 Attempt all questions
a) Prove that in case of three dimensional rotations of object the rotations are

noncommutative.
b) Reflect the diamond shape polygon whose vertices are A (-1, 0), B (0, -2), C (1, 0) and $\mathrm{D}(0,2)$ about the line $\mathrm{y}=\mathrm{x}+2$.

Attempt all questions
a) Explain B-spline curve and mention its advantages.
b) Derive the equation for Bezier curve for four points using DeCasteljau algorithm.

## Attempt all questions

a) With reference to finite element analysis, discuss the treatment of boundary condition using elimination approach.
b) Show in Figure 1 two springs connected in series, having stiffness 12 and $8 \mathrm{~N} / \mathrm{mm}$ respectively. One end of the assembly is fixed and a force of 60 N is applied at the end. Using finite element method;
(i) Derive global stiffness matrix
(ii) Derive global load vector
(iii) Find displacement of all the nodes


Figure 1

## Attempt all questions

a) Explain the concepts of FEM. Discuss the different steps involved in FEA in detailed.
b) A four bar truss is as shown in Figure 2. Assuming that for each element, the crosssectional area is $400 \mathrm{~mm}^{2}$ and modulus of elasticity is 200 GPa , determine the nodal displacements. Length of each element is in mm .


Figure 2
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a) Discuss classification of optimization problem using suitable examples.
b) A Cylindrical shell of the heat exchanger is required to accommodate a total of 100 m length of standard diameter copper tubes. One meter square cross - sectional area inside the shell can accommodate 200 copper tubes. Design the heat exchanger shell with an objective of minimizing the cost of the heat exchanger, by using the following data:
Cost of the copper tubes = Rs. 20,000
Cost of the heat exchanger shell = Rs. $60,000 \mathrm{D}^{2.5} \mathrm{~L}$
Cost of floor space occupied by the heat exchanger $=$ Rs. $10,000 \mathrm{DL}$
Where, $\mathrm{D}=$ diameter of the heat exchanger shell in meter
$\mathrm{L}=$ length of the heat exchanger shell in meter.


