

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VI (NEW) EXAMINATION – WINTER 2024****Subject Code:2161903****Date:05-12-2024****Subject Name: Computer Aided Design****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- | | | |
|------------|---|-----------|
| Q.1 | (a) Enlist significant benefits of Computer Aided Design over conventional design process. | 03 |
| | (b) What is graphic standard? Explain different CAD standards. | 04 |
| | (c) Explain DDA line drawing algorithm with its drawbacks. | 07 |
| Q.2 | (a) Explain GKS standard. | 03 |
| | (b) Compare Analytic and Synthetic curves. | 04 |
| | (c) Draw line segment joining (20,10) and (25,14) using Bresenham line generation algorithm. | 07 |
| | OR | |
| | (c) A Hermite cubic spline curve starts from $P_0(0, 3)$ and ends at $P_1(4, 2)$. Point $P_2(4, 7)$ is such that the tangent at start point joins P_0 to P_2 and tangent at end point joins P_2 to P_1 . Find the coordinates of a point on curve for $u = 0.25$. | 07 |
| Q.3 | (a) Represent Homogeneous transformation matrices for
(i) Rotation about x- axis in 3D (ii) Translation in 3D | 03 |
| | (b) Compare and contrast C-rep and B-rep solid modeling techniques. | 04 |
| | (c) Obtain the mirror reflection of the triangle formed by vertices $A(0,3)$, $B(2,0)$, $C(3,2)$ about the line passing through the points (1,3) and (-1,-1). | 07 |
| | OR | |
| Q.3 | (a) Enlist the various methods of geometric modeling. Discuss wire frame modeling. | 03 |
| | (b) Explain the terms 'geometry' and 'topology' in solid modeling. | 04 |
| | (c) Find the 3x3 homogeneous co-ordinate transformation matrix for each of the following:
i. Shift an image to the right by 3 units.
ii. Shift the image up by 2 units and down 1 units.
iii. Move the image down $2/3$ units and left 4 units. | 07 |
| Q.4 | (a) Derive an equation of parametric representation of line with a neat sketch. | 03 |
| | (b) Under which condition 'plane strain condition' can be used to reduce a 3D problem into a 2D form? | 04 |
| | (c) State and explain properties of a Bezier curves. | 07 |
| | OR | |
| Q.4 | (a) Give step by step procedure of Finite Element Analysis. | 03 |
| | (b) Explain Plain Stresses and Plain Strains in FEA. | 04 |
| | (c) Explain different types of elements used in FEA? Explain in brief. | 07 |
| Q.5 | (a) Solution of an engineering problem using an FEA software involves 3 stages: preprocessing, solution, postprocessing. Summarize what is included in each stage | 03 |
| | (b) Explain shape functions in natural coordinate system. | 04 |

- (c) Derive the Potential Energy equation for the spring system shown in figure 1. Determine the displacements of nodes of the same using the minimum potential energy principle. Take $k_1 = k_2 = 40 \text{ N/mm}$, $k_3 = 60 \text{ N/mm}$, $k_4 = 90 \text{ N/mm}$, $P_2 = 100 \text{ N}$ and $P_3 = 60 \text{ N}$. 07

OR

- Q.5 (a) Explain the concept of degrees of freedom in case of FEA. 03
 (b) What are the properties of the stiffness matrix? 04
 (c) An axial load of 20 KN applied on the bar as shown in figure 2. Using finite element method find the nodal displacement, stresses in each section and the reaction forces. 07

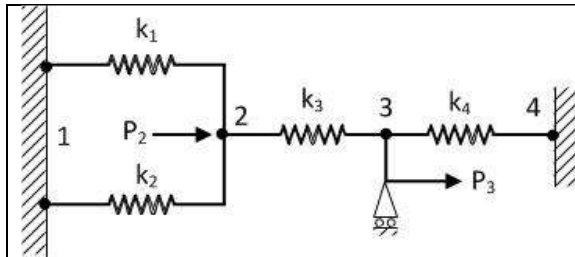


Figure. 1

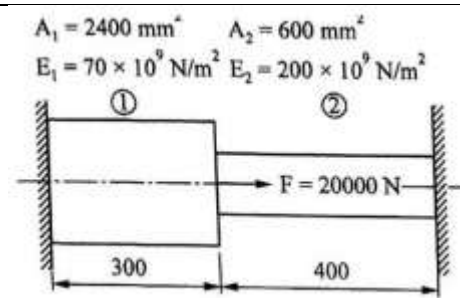


Figure. 2
