

CENTRAL POLYTECHNIC COLLEGE, THARAMANI – 600113.

(An Autonomous Institution)

**DEPARTMENT OF MECHANICAL ENGINEERING  
(CAD)**



**QUESTION BANK**

**EMC41010 - GEOMETRIC MODELLING AND FEA**

**(E – SCHEME)**



U.NO	Q NO	QUESTIONS	
1	11	An ellipse has how many axes of symmetry? (a) One (c) Three <b>Ans:Two</b>	(b) Two (d) Four
1	12	Bresenham's algorithm uses only... (a) Integer arithmetic (c) Trigonometric functions <b>Ans:Integer arithmetic</b>	(b) Floating-point arithmetic (d) Logarithmic functions
1	13	The midpoint circle algorithm is a variation of which algorithm? (a) DDA (c) Sutherland-Hodgman <b>Ans:Bresenham's line algorithm</b>	(b) Scan-line (d) Bresenham's line algorithm
1	14	The process of changing the position, size, or orientation of an object is called... (a) Transformation (c) Windowing <b>Ans:Transformation</b>	(b) Clipping (d) Projection
1	15	Which transformation moves an object without changing its shape or size? (a) Scaling (c) Translation <b>Ans:Translation</b>	(b) Rotation (d) Shear
1	16	Changing the size of an object is called... (a) Translation (c) Scaling <b>Ans:Scaling</b>	(b) Rotation (d) Reflection
1	17	Turning an object about a fixed point is called... (a) Translation (c) Scaling <b>Ans:Rotation</b>	(b) Rotation (d) Shearing
1	18	The coordinate system used to describe the objects in a scene is called... (a) World coordinate system (c) Screen coordinate system <b>Ans:World coordinate system</b>	(b) Device coordinate system (d) Viewport coordinate system
1	19	What is a 'window' in computer graphics? (a) A part of the screen (c) A user interface element <b>Ans:An area of the scene to be viewed</b>	(b) An area of the scene to be viewed (d) A type of software
1	20	The area on the display device where the window is mapped is called a... (a) Viewport (c) Screen <b>Ans:Viewport</b>	(b) Clipping region (d) Canvas

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1	21	A 2D point (x, y) is translated by (tx, ty) to a new point (x', y'). What is x'? (a) $x + tx$ (b) $x - tx$ (c) $x * tx$ (d) $x / tx$ <b>Ans: <math>x + tx</math></b>
1	22	To rotate a point (x, y) about the origin, which parameters are needed? (a) Translation vector (b) Scaling factors (c) Angle of rotation (d) A second point <b>Ans: Angle of rotation</b>
1	23	If the scaling factor $S_x$ is greater than 1, the object becomes... (a) Smaller (b) Wider (c) Taller (d) Thinner <b>Ans: Wider</b>
1	24	The matrix for a 2D rotation is based on which functions? (a) Logarithmic (b) Exponential (c) Sine and Cosine (d) Tangent and Cotangent <b>Ans: Sine and Cosine</b>
1	25	Why are homogeneous coordinates used in graphics transformations? (a) To simplify calculations (b) To represent all transformations as matrix multiplications (c) To handle 3D objects (d) To improve image quality <b>Ans: To represent all transformations as matrix multiplications</b>
1	26	How is a 2D point (x, y) represented in homogeneous coordinates? (a) (x, y, 0) (b) (x, y, 1) (c) (x, y, w) (d) (x, y) <b>Ans: (x, y, w)</b>
1	27	The matrix for a 2D transformation in homogeneous coordinates is of size... (a) 2x2 (b) 2x3 (c) 3x2 (d) 3x3 <b>Ans: 3x3</b>
1	28	Combined transformations are also known as... (a) Primitive transformations (b) Concatenated transformations (c) Simple transformations (d) Mixed transformations <b>Ans: Concatenated transformations</b>
1	29	The order of transformation matrices in a multiplication is... (a) Not important (b) Important (c) Always commutative (d) Always from left to right <b>Ans: Important</b>
1	30	To rotate an object about an arbitrary point P, what is the first step? (a) Rotate the object (b) Scale the object (c) Translate P to the origin (d) Translate origin to P <b>Ans: Translate P to the origin</b>

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1	31	The process of removing parts of an image outside a specified window is called... (a) Cropping (b) Slicing (c) Deleting (d) Clipping <b>Ans:Clipping</b>
1	32	Which algorithm is commonly used for line clipping? (a) Cohen-Sutherland (b) DDA (c) Bresenham's (d) Scan-line <b>Ans:Cohen-Sutherland</b>
1	33	The Cohen-Sutherland algorithm uses a _____ code to classify line endpoints. (a) 2-bit (b) 4-bit (c) 6-bit (d) 8-bit <b>Ans:4-bit</b>
1	34	How many axes are there in a 3D coordinate system? (a) 2 (b) 3 (c) 4 (d) 1 <b>Ans:3</b>
1	35	3D scaling requires how many scaling factors? (a) 1 (b) 2 (c) 3 (d) 4 <b>Ans:3</b>
1	36	In a 3D system, rotation can occur about... (a) The origin only (b) The x-axis only (c) The y-axis only (d) Any axis in space <b>Ans:Any axis in space</b>
1	37	The homogeneous coordinate matrix for 3D transformations is of size... (a) 3x3 (b) 3x4 (c) 4x3 (d) 4x4 <b>Ans:4x4</b>
1	38	In the DDA algorithm, if the slope 'm' is less than 1, we... (a) Increment x by 1 (b) Increment y by 1 (c) Increment both x and y (d) Decrement x by 1 <b>Ans:Increment x by 1</b>
1	39	The mapping from a window to a viewport is a... (a) Rotation (b) Translation (c) Transformation (d) Scaling <b>Ans:Transformation</b>
1	40	A reflection is a type of transformation that produces a _____ of the object. (a) Larger image (b) Smaller image (c) Mirror image (d) Rotated image <b>Ans:Mirror image</b>

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1	41	<p>Polygons are examples of...</p> <p>(a) Graphic primitives (b) Input devices</p> <p>(c) Output devices (d) Shading models</p> <p><b>Ans:Graphic primitives</b></p>
1	42	<p>The decision parameter in Bresenham's algorithm helps to select the...</p> <p>(a) Next color (b) Next line</p> <p>(c) Next pixel (d) Next shape</p> <p><b>Ans:Next pixel</b></p>
1	43	<p>Scaling an object with factors <math>S_x = 1</math> and <math>S_y = 1</math> will...</p> <p>(a) Double its size (b) Halve its size</p> <p>(c) Keep its size unchanged (d) Delete the object</p> <p><b>Ans:Keep its size unchanged</b></p>
1	44	<p>Which transformation can cause the shape of an object to change?</p> <p>(a) Translation (b) Uniform Scaling</p> <p>(c) Rotation (d) Differential Scaling</p> <p><b>Ans:Differential Scaling</b></p>
1	45	<p>The homogeneous parameter 'w' is usually set to...</p> <p>(a) 0 (b) 1</p> <p>(c) -1 (d) Infinity</p> <p><b>Ans:1</b></p>
1	46	<p>If both endpoints of a line have a clipping outcode of 0000, the line is...</p> <p>(a) Completely outside (b) Completely inside</p> <p>(c) Partially inside (d) Must be clipped</p> <p><b>Ans:Completely inside</b></p>
1	47	<p>A 3D translation requires a vector with how many components?</p> <p>(a) 1 (b) 2</p> <p>(c) 3 (d) 4</p> <p><b>Ans:3</b></p>
1	48	<p>The midpoint ellipse algorithm calculates pixel positions for _____ of the ellipse.</p> <p>(a) the full boundary (b) half</p> <p>(c) one quadrant (d) one eighth</p> <p><b>Ans:one quadrant</b></p>
1	49	<p>The coordinates used by a display device are called...</p> <p>(a) World coordinates (b) Normalized coordinates</p> <p>(c) Device coordinates (d) Model coordinates</p> <p><b>Ans:Device coordinates</b></p>
1	50	<p>The result of a sequence of transformations T1 followed by T2 is represented by the matrix...</p> <p>(a) <math>T_1 + T_2</math> (b) <math>T_1 - T_2</math></p> <p>(c) <math>T_2 * T_1</math> (d) <math>T_1 * T_2</math></p> <p><b>Ans:<math>T_2 * T_1</math></b></p>

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2	1	<p>Geometric modeling is the process of creating a...</p> <p>(a) Physical model (b) 2D drawing</p> <p>(c) Mathematical representation of a 3D object (d) User interface</p> <p><b>Ans:Mathematical representation of a 3D object</b></p>
2	2	<p>Which type of modeling represents an object using only lines and curves?</p> <p>(a) Solid modeling (b) Surface modeling</p> <p>(c) Wireframe modeling (d) Hybrid modeling</p> <p><b>Ans:Wireframe modeling</b></p>
2	3	<p>A major disadvantage of wireframe modeling is...</p> <p>(a) High computational cost (b) Ambiguity in visualization</p> <p>(c) Large file size (d) Difficulty in creating</p> <p><b>Ans:Ambiguity in visualization</b></p>
2	4	<p>Which modeling technique defines an object by its bounding faces?</p> <p>(a) Wireframe modeling (b) Surface modeling</p> <p>(c) Solid modeling (d) Parametric modeling</p> <p><b>Ans:Surface modeling</b></p>
2	5	<p>Which is the most complete and unambiguous representation of a 3D object?</p> <p>(a) Wireframe model (b) Surface model</p> <p>(c) Solid model (d) 2D projection</p> <p><b>Ans:Solid model</b></p>
2	6	<p>The simplest form of geometric modeling is</p> <p>(a) Wireframe model (b) Surface model</p> <p>(c) Solid model (d) Thermal model</p> <p><b>Ans:Wireframe model</b></p>
2	7	<p>A model that shows all edges of an object, including hidden ones, is a...</p> <p>(a) Solid model (b) Surface model</p> <p>(c) Wireframe model (d) Raster model</p> <p><b>Ans:Wireframe model</b></p>
2	8	<p>Creating a model of a car body panel is best done with...</p> <p>(a) Wireframe modeling (b) Surface modeling</p> <p>(c) Solid modeling (d) Point modeling</p> <p><b>Ans:Surface modeling</b></p>
2	9	<p>Which model type can be used to calculate an object's mass properties?</p> <p>(a) Wireframe (b) Surface</p> <p>(c) Solid (d) Mesh</p> <p><b>Ans:Solid</b></p>
2	10	<p>The three types of geometric modeling are wireframe, surface, and...</p> <p>(a) Point (b) Line</p> <p>(c) Solid (d) Curve</p> <p><b>Ans:Solid</b></p>

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2	11	A curve defined by an equation like $y = f(x)$ is an... (a) Implicit curve (b) Explicit curve (c) Parametric curve (d) Synthetic curve <b>Ans:Explicit curve</b>
2	12	In parametric representation, coordinates (x, y, z) are expressed as functions of... (a) Each other (b) A single parameter, 'u' (c) The origin point (d) The curve length <b>Ans:A single parameter, 'u'</b>
2	13	The parameter 'u' in a parametric curve usually varies in the range... (a) 0 to infinity (b) -1 to 1 (c) 0 to 1 (d) -infinity to infinity <b>Ans:0 to 1</b>
2	14	Which type of curve is independent of the coordinate system? (a) Explicit (b) Implicit (c) Parametric (d) All curves <b>Ans:Parametric</b>
2	15	A circle can be represented parametrically using which functions? (a) Sine and Cosine (b) Tangent and Secant (c) Logarithmic (d) Exponential <b>Ans:Sine and Cosine</b>
2	16	Curves like circles, ellipses, and parabolas are known as... (a) Synthetic curves (b) Free-form curves (c) Analytic curves (d) Spline curves <b>Ans:Analytic curves</b>
2	17	The vector $P(u) = P\_start + u * (P\_end - P\_start)$ represents a... (a) Circle (b) Line segment (c) Parabola (d) Spline <b>Ans:Line segment</b>
2	18	What is the main advantage of using parametric curves over implicit or explicit forms? (a) They are simpler to write (b) They can handle vertical tangents and closed loops easily (c) They are faster to compute (d) They use less memory <b>Ans:They can handle vertical tangents and closed loops easily</b>
2	19	Curves that are defined by a set of control points are called... (a) Analytic curves (b) Synthetic curves (c) Implicit curves (d) Explicit curves <b>Ans:Synthetic curves</b>
2	20	A cubic spline is a curve constructed from piecewise... (a) Linear polynomials (b) Quadratic polynomials (c) Cubic polynomials (d) Quartic polynomials <b>Ans:Cubic polynomials</b>

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2	21	The points that a spline curve passes through are called... (a) Control points (b) Knots or data points (c) Vertices (d) Tangents <b>Ans:Knots or data points</b>
2	22	A Bezier curve is defined by a set of... (a) Data points (b) Knots (c) Control points (d) Tangent vectors <b>Ans:Control points</b>
2	23	For a Bezier curve, how many control points are needed for a cubic curve? (a) 2 (b) 3 (c) 4 (d) 5 <b>Ans:4</b>
2	24	Does a Bezier curve generally pass through all its control points? (a) Yes, always (b) Only the first and last (c) Only the middle ones (d) No, never <b>Ans:Only the first and last</b>
2	25	The shape of a Bezier curve is contained within the _____ of its control points. (a) Bounding box (b) Convex hull (c) Circle (d) Sphere <b>Ans:Convex hull</b>
2	26	Which type of curve offers local control over its shape? (a) Bezier curve (b) Cubic Spline (c) B-Spline (d) Neither <b>Ans: B-Spline</b>
2	27	The "degree" of a Bezier curve is related to the number of control points (n) by... (a) degree = n (b) degree = n + 1 (c) degree = n - 1 (d) degree = n / 2 <b>Ans:degree = n - 1</b>
2	28	Blending functions used in Bezier curves are called... (a) Fourier functions (b) Spline functions (c) Bernstein polynomials (d) Lagrange polynomials <b>Ans:Bernstein polynomials</b>
2	29	To join two Bezier curve segments smoothly, what must be aligned? (a) The last point of the first curve and the first of the second (b) The first two points of each curve (c) The last two points of the first and the first two of the second (d) The middle points of both curves <b>Ans:The last two points of the first and the first two of the second</b>
2	30	A cubic spline provides what kind of continuity at the joints? (a) C0 (Positional) (b) C1 (Tangential) (c) C2 (Curvature) (d) All of the above <b>Ans:All of the above</b>

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2	31	<p>What is a major advantage of B-spline curves over Bezier curves?</p> <p>(a) They are simpler (b) They pass through all control points  (c) They allow the degree of the curve to be independent of the number of control points (d) They are always closed curves</p> <p><b>Ans:They allow the degree of the curve to be independent of the number of control points</b></p>
2	32	<p>The shape of a B-spline is controlled by control points and a...</p> <p>(a) Knot vector (b) Tangent vector  (c) Normal vector (d) Curvature vector</p> <p><b>Ans:Knot vector</b></p>
2	33	<p>What does 'B' in B-spline stand for?</p> <p>(a) Basic (b) Bezier  (c) Blending (d) Basis</p> <p><b>Ans:Basis</b></p>
2	34	<p>If you move a single control point in a B-spline curve, the change is...</p> <p>(a) Global (b) Local  (c) Not possible (d) Affects only the endpoints</p> <p><b>Ans:Local</b></p>
2	35	<p>A uniform B-spline has knots that are...</p> <p>(a) Randomly spaced (b) Equally spaced  (c) Clustered at the ends (d) Logarithmically spaced</p> <p><b>Ans:Equally spaced</b></p>
2	36	<p>Extending a 2D curve into 3D by sweeping it along a path creates a...</p> <p>(a) Ruled surface (b) Surface of revolution  (c) Tabulated cylinder (d) Blended surface</p> <p><b>Ans:Tabulated cylinder</b></p>
2	37	<p>Rotating a 2D curve around an axis creates a...</p> <p>(a) Ruled surface (b) Surface of revolution  (c) Tabulated cylinder (d) Bezier surface</p> <p><b>Ans:Surface of revolution</b></p>
2	38	<p>A surface defined by a grid of control points is a...</p> <p>(a) Bezier surface (b) Analytic surface  (c) Implicit surface (d) Quadric surface</p> <p><b>Ans:Bezier surface</b></p>
2	39	<p>A surface that can be generated by moving a straight line is called a...</p> <p>(a) Lofted surface (b) Coons patch  (c) Ruled surface (d) Filleted surface</p> <p><b>Ans:Ruled surface</b></p>
2	40	<p>A car's hood is a good example of a...</p> <p>(a) Plane surface (b) Free-form surface  (c) Quadric surface (d) Ruled surface</p> <p><b>Ans:Free-form surface</b></p>

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2	41	The intersection of two surfaces results in a... (a) Point (b) Curve (c) Surface (d) Solid <b>Ans:Curve</b>
2	42	What is a Coons patch? (a) A surface defined by four boundary curves (b) A surface defined by a grid of points (c) A surface created by revolution (d) A type of solid model <b>Ans:A surface defined by four boundary curves</b>
2	43	The parametric representation of a surface requires how many parameters? (a) One (u) (b) Two (u, v) (c) Three (u, v, w) (d) Four (x, y, z, w) <b>Ans:Two (u, v)</b>
2	44	A sphere, cylinder, and cone are all examples of... (a) Free-form surfaces (b) Quadric surfaces (c) Bezier surfaces (d) B-spline surfaces <b>Ans:Quadric surfaces</b>
2	45	The line segment between the first two control points of a Bezier curve defines the... (a) Curvature at the start (b) Tangent at the start (c) Length of the curve (d) Midpoint of the curve <b>Ans:Tangent at the start</b>
2	46	An implicit equation for a circle is... (a) $x=r\cos(u)$ , $y=r\sin(u)$ (b) $y = \sqrt{r^2 - x^2}$ (c) $x^2 + y^2 - r^2 = 0$ (d) $y = mx + c$ <b>Ans:<math>x^2 + y^2 - r^2 = 0</math></b>
2	47	In which industry is surface modeling most critical? (a) Construction (b) Automotive and Aerospace (c) Electronics (d) Packaged Goods <b>Ans:Automotive and Aerospace</b>
2	48	NURBS, a common curve/surface type in CAD, stands for... (a) Non-Uniform Rational Bezier Spline (b) New Uniform Rotational B-Spline (c) Non-Uniform Rational B-Spline (d) Null-Uniform Rotational Bezier Spline <b>Ans:Non-Uniform Rational B-Spline</b>
2	49	Creating a surface by "skinning" a set of cross-sectional curves is called... (a) Revolution (b) Sweeping (c) Lofting (d) Ruling <b>Ans:Lofting</b>
2	50	A linear Bezier curve with two control points, P0 and P1, is a... (a) Parabola (b) Circle (c) Straight line (d) Cubic curve <b>Ans:Straight line</b>

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3	1	<p>What is a key characteristic of solid models compared to surface or wireframe models?</p> <p>(a) They are hollow (b) They are ambiguous (c) They represent volume (d) They only show edges</p> <p><b>Ans:They represent volume</b></p>
3	2	<p>Which of the following is a primary solid modeling technique?</p> <p>(a) Boundary Representation (B-rep) (b) Wireframe Representation (c) Surface Representation (d) Point Representation</p> <p><b>Ans:Boundary Representation (B-rep)</b></p>
3	3	<p>In Boundary Representation (B-rep), a solid is defined by its...</p> <p>(a) Internal volume (b) Center of mass (c) Bounding surfaces or faces (d) Primitive shapes</p> <p><b>Ans:Bounding surfaces or faces</b></p>
3	4	<p>What is the most basic element in a B-rep model's hierarchy?</p> <p>(a) Face (b) Edge (c) Vertex (d) Solid</p> <p><b>Ans:Vertex</b></p>
3	5	<p>An 'edge' in a B-rep model is the intersection of two...</p> <p>(a) Vertices (b) Faces (c) Solids (d) Loops</p> <p><b>Ans:Faces</b></p>
3	6	<p>A 'face' in a B-rep model is a bounded portion of a...</p> <p>(a) Line (b) Point cloud (c) Surface (d) Solid</p> <p><b>Ans:Surface</b></p>
3	7	<p>A closed chain of edges on a single face is called a...</p> <p>(a) Loop (b) Handle (c) Shell (d) Body</p> <p><b>Ans:Loop</b></p>
3	8	<p>The principle of "manifold" in B-rep means that every edge is shared by exactly...</p> <p>(a) One face (b) Two faces (c) Three faces (d) Four faces</p> <p><b>Ans:Two faces</b></p>
3	9	<p>What does 'watertight' mean in the context of a solid model?</p> <p>(a) The model is filled with water (b) The model has no gaps or holes in its boundary (c) The model can hold water (d) The model is made of waterproof material</p> <p><b>Ans:The model has no gaps or holes in its boundary</b></p>
3	10	<p>Euler's formula relates the number of Vertices (V), Edges (E), and...</p> <p>(a) Faces (F) (b) Loops (L) (c) Handles (H) (d) Bodies (B)</p> <p><b>Ans:Faces (F)</b></p>



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3	21	The data structure used to represent a CSG model is typically a... (a) Linked list (b) Array (c) Binary tree (d) Stack <b>Ans:Binary tree</b>
3	22	In a CSG binary tree, what do the 'leaf' nodes represent? (a) Boolean operations (b) The final object (c) Primitive solids (d) Transformation matrices <b>Ans:Primitive solids</b>
3	23	In a CSG binary tree, what do the 'internal' or 'non-leaf' nodes represent? (a) Primitive solids (b) The final object (c) Boolean operations (d) Vertices <b>Ans:Boolean operations</b>
3	24	Is a CSG model representation ambiguous? (a) Yes (b) No (c) Sometimes (d) Only for complex models <b>Ans:No</b>
3	25	A major advantage of CSG is that it is... (a) Easy to render (b) Always topologically valid (c) Fast for analysis (d) Easy to create holes <b>Ans:Always topologically valid</b>
3	26	Creating a 3D solid by pulling a 2D shape along a path is called... (a) Lofting (b) Revolution (c) Sweeping or Extrusion (d) Bending <b>Ans:Sweeping or Extrusion</b>
3	27	Creating a 3D solid by rotating a 2D profile around an axis is called... (a) Lofting (b) Revolution (c) Sweeping (d) Bending <b>Ans:Revolution</b>
3	28	The process of adding a rounded edge to a corner of a solid model is called... (a) Chamfering (b) Filletting (c) Bending (d) Twisting <b>Ans:Filletting</b>
3	29	The process of adding a beveled or angled edge to a corner is called... (a) Chamfering (b) Filletting (c) Rounding (d) Twisting <b>Ans:Chamfering</b>
3	30	A "shell" operation in solid modeling is used to... (a) Add a protective coating (b) Make a solid object hollow (c) Combine two solids (d) Cut a solid in half <b>Ans:Make a solid object hollow</b>

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3	31	A Boolean operation is a form of solid... (a) Creation (b) Manipulation (c) Analysis (d) Rendering <b>Ans:Manipulation</b>
3	32	Changing the dimensions of a solid model is a form of... (a) Scaling (b) Twisting (c) Bending (d) Tapering <b>Ans:Scaling</b>
3	33	Which application heavily relies on solid modeling for analysis? (a) Video games (b) Finite Element Analysis (FEA) (c) 2D animation (d) Web design <b>Ans:Finite Element Analysis (FEA)</b>
3	34	What does CAM stand for in the context of solid modeling applications? (a) Computer Aided Manufacturing (b) Computer Aided Manipulation (c) Central Access Memory (d) Computer Aided Motion <b>Ans:Computer Aided Manufacturing</b>
3	35	Using a solid model to create a physical prototype layer by layer is called... (a) CNC Machining (b) 3D Printing (c) Casting (d) Forging <b>Ans:3D Printing</b>
3	36	Calculating the volume, weight, or center of gravity of a part is a... (a) Design application (b) Manufacturing application (c) Analysis application (d) Rendering application <b>Ans:Analysis application</b>
3	37	Creating assembly drawings and checking for interference between parts is an application of... (a) Individual part modeling (b) Solid modeling in assemblies (c) Surface modeling (d) Wireframe modeling <b>Ans:Solid modeling in assemblies</b>
3	38	The file format commonly used to export solid models for 3D printing is... (a) .docx (b) .jpeg (c) .dwg (d) .stl <b>Ans:.stl</b>
3	39	What is "kinematic analysis" in the context of solid modeling? (a) Analyzing the color and texture (b) Analyzing the motion of assembled parts (c) Analyzing the internal stress (d) Analyzing the manufacturing cost <b>Ans:Analyzing the motion of assembled parts</b>
3	40	B-rep is considered a good representation for... (a) Storing models compactly (b) Quick rendering and display (c) Parametric design changes (d) Creating complex free-form shapes <b>Ans:Quick rendering and display</b>

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3	41	<p>A disadvantage of CSG is that it is difficult to...</p> <p>(a) Model objects with sculpted or free-form surfaces      (b) Create holes</p> <p>(c) Ensure validity      (d) Store the model</p> <p><b>Ans:Model objects with sculpted or free-form surfaces</b></p>
3	42	<p>The data structure for B-rep is typically a...</p> <p>(a) Tree      (b) Graph</p> <p>(c) Simple array      (d) Stack</p> <p><b>Ans:Graph</b></p>
3	43	<p>The operation of "tapering" an extrusion does what?</p> <p>(a) Makes the extrusion curved      (b) Makes the extrusion follow a path</p> <p>(c) Makes the end of the extrusion smaller or larger than the start      (d) Makes the extrusion hollow</p> <p><b>Ans:Makes the end of the extrusion smaller or larger than the start</b></p>
3	44	<p>Subtracting a small sphere from a larger sphere results in a...</p> <p>(a) Hollow sphere      (b) Donut shape</p> <p>(c) Solid sphere      (d) Pac-Man shape</p> <p><b>Ans:Hollow sphere</b></p>
3	45	<p>Creating photorealistic images of a solid model for marketing is an example of a...</p> <p>(a) Manufacturing application      (b) Analysis application</p> <p>(c) Visualization/Rendering application      (d) Kinematic application</p> <p><b>Ans:Visualization/Rendering application</b></p>
3	46	<p>The term "topology" in solid modeling refers to the...</p> <p>(a) Exact geometry and dimensions      (b) Adjacency and connectivity relationships between elements</p> <p>(c) Color and texture      (d) Mass and volume</p> <p><b>Ans:Adjacency and connectivity relationships between elements</b></p>
3	47	<p>In a CSG tree, transformations like 'move' or 'rotate' are often applied to which nodes?</p> <p>(a) Operation nodes      (b) Root node</p> <p>(c) Leaf (primitive) nodes      (d) All nodes</p> <p><b>Ans:Leaf (primitive) nodes</b></p>
3	48	<p>Lofting is a solid creation method that generates a solid between...</p> <p>(a) Two points      (b) Two or more 2D profiles</p> <p>(c) An axis and a profile      (d) A path and a profile</p> <p><b>Ans:Two or more 2D profiles</b></p>
3	49	<p>Does Euler's formula <math>V-E+F=2</math> apply to a solid with a hole through it (like a donut)?</p> <p>(a) Yes, always      (b) No</p> <p>(c) Only if it's a small hole      (d) Only if it's a cube</p> <p><b>Ans:No</b></p>
3	50	<p>What is "interference detection"?</p> <p>(a) Detecting computer viruses      (b) Checking if two or more solid parts in an assembly occupy the same space</p> <p>(c) Finding errors in a drawing      (d) Improving radio signals</p> <p><b>Ans:Checking if two or more solid parts in an assembly occupy the same space</b></p>

U.NO	Q NO	QUESTIONS
4	1	<p>What does FEM stand for?</p> <p>(a) Fast Element Method (b) Final Element Model</p> <p>(c) Finite Element Method (d) Fictional Element Method</p> <p><b>Ans:Finite Element Method</b></p>
4	2	<p>FEM is a _____ technique for obtaining approximate solutions.</p> <p>(a) Analytical (b) Experimental</p> <p>(c) Numerical (d) Graphical</p> <p><b>Ans:Numerical</b></p>
4	3	<p>The first step in the general procedure of FEM is...</p> <p>(a) Assembling the global stiffness matrix (b) Applying boundary conditions</p> <p>(c) Discretization of the domain (d) Solving for displacements</p> <p><b>Ans:Discretization of the domain</b></p>
4	4	<p>In FEM, a continuous domain is replaced by a set of...</p> <p>(a) Points (b) Lines</p> <p>(c) Finite elements (d) Equations</p> <p><b>Ans:Finite elements</b></p>
4	5	<p>The points connecting the elements are called...</p> <p>(a) Vertices (b) Nodes</p> <p>(c) Corners (d) Joints</p> <p><b>Ans:Nodes</b></p>
4	6	<p>The process of dividing the problem domain into a collection of smaller sub-domains is called...</p> <p>(a) Integration (b) Differentiation</p> <p>(c) Discretization (d) Assembling</p> <p><b>Ans:Discretization</b></p>
4	7	<p>A finer mesh in FEM generally leads to...</p> <p>(a) A less accurate solution (b) A more accurate solution</p> <p>(c) A faster solution (d) An unstable solution</p> <p><b>Ans:A more accurate solution</b></p>
4	8	<p>The arrangement of elements in the discretized domain is called a...</p> <p>(a) Grid (b) Network</p> <p>(c) Map (d) Mesh</p> <p><b>Ans:Mesh</b></p>
4	9	<p>A 1D element is also known as a _____ element.</p> <p>(a) Area (b) Volume</p> <p>(c) Line (d) Surface</p> <p><b>Ans:Line</b></p>
4	10	<p>A triangular element is an example of a...</p> <p>(a) 1D element (b) 2D element</p> <p>(c) 3D element (d) 4D element</p> <p><b>Ans:2D element</b></p>

U.NO	Q NO	QUESTIONS
4	11	A tetrahedron or a hexahedron (brick) element is an example of a... (a) 1D element (b) 2D element (c) 3D element (d) Point element <b>Ans:3D element</b>
4	12	A spar element is used to model _____ loading. (a) Torsional (b) Bending (c) Axial (d) Shear <b>Ans:Axial</b>
4	13	In structural analysis, the stiffness matrix [K] relates... (a) Force and stress (b) Stress and strain (c) Force and displacement (d) Displacement and strain <b>Ans:Force and displacement</b>
4	14	What does a load vector {F} represent? (a) Internal forces in an element (b) External forces applied at the nodes (c) Reactions at the supports (d) Stresses in the element <b>Ans:External forces applied at the nodes</b>
4	15	The size of the global stiffness matrix for a system depends on the total number of... (a) Elements (b) Nodes (c) Degrees of freedom (d) Supports <b>Ans:Degrees of freedom</b>
4	16	The stiffness matrix of any stable structure is always... (a) Symmetric (b) Skew-symmetric (c) A null matrix (d) An identity matrix <b>Ans:Symmetric</b>
4	17	What property does 'k' represent in the simple spring equation $F=kx$ ? (a) Force (b) Displacement (c) Stiffness (d) Length <b>Ans:Stiffness</b>
4	18	A 1D linear spar element has how many nodes? (a) 1 (b) 2 (c) 3 (d) 4 <b>Ans:2</b>
4	19	The degrees of freedom (DOF) for a node in a 1D spar element is... (a) One translation (u) (b) One translation (u) and one rotation (c) Two translations (u, v) (d) Three translations <b>Ans:One translation (u)</b>
4	20	The total number of DOFs for a 1D linear spar element is... (a) 1 (b) 2 (c) 3 (d) 4 <b>Ans:2</b>

U.NO	Q NO	QUESTIONS
4	21	The formula for the stiffness matrix of a 1D spar element is... (a) $AE/L$ (b) $(AE/L) * \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ (c) $(E/L) * \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ (d) $(A/L) * \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$ <b>Ans: <math>(AE/L) * \begin{bmatrix} 1 &amp; -1 \\ -1 &amp; 1 \end{bmatrix}</math></b>
4	22	In the formula $k = AE/L$ , what does 'A' represent? (a) Applied load (b) Axial displacement (c) Cross-sectional area (d) Angle <b>Ans: Cross-sectional area</b>
4	23	In the formula $k = AE/L$ , what does 'E' represent? (a) Element length (b) Energy (c) Young's Modulus of Elasticity (d) Error <b>Ans: Young's Modulus of Elasticity</b>
4	24	A quadratic spar element has how many nodes? (a) 2 (b) 3 (c) 4 (d) 5 <b>Ans: 3</b>
4	25	A plane truss element is a 1D spar element oriented in... (a) 1D space (b) 2D space (c) 3D space (d) Any space <b>Ans: 2D space</b>
4	26	How many DOFs are there per node for a 2D plane truss element? (a) 1 (b) 2 (c) 3 (d) 6 <b>Ans: 2</b>
4	27	Using a quadratic element instead of a linear element for the same number of nodes gives... (a) Lower accuracy (b) Higher accuracy (c) No change in accuracy (d) Faster computation <b>Ans: Higher accuracy</b>
4	28	After finding the nodal displacements $\{u\}$ , what is the next step to find element stress? (a) Re-discretize the model (b) Calculate strain, then use it to find stress (c) Apply boundary conditions again (d) Re-solve the matrix equation <b>Ans: Calculate strain, then use it to find stress</b>
4	29	For a 1D spar, strain ( $\epsilon$ ) is calculated as... (a) Stress / Area (b) Change in length / Original length (c) Force / Area (d) Displacement / Stress <b>Ans: Change in length / Original length</b>
4	30	For a 1D spar, stress ( $\sigma$ ) is related to strain ( $\epsilon$ ) by which equation? (a) $\sigma = E / \epsilon$ (b) $\sigma = \epsilon / E$ (c) $\sigma = E * \epsilon$ (d) $\sigma = E + \epsilon$ <b>Ans: <math>\sigma = E * \epsilon</math></b>

- 4 31 The final step in the FEM procedure is...  
 (a) Assembling the stiffness matrix (b) Solving the equations  
 (c) Post-processing and interpreting results (d) Applying boundary conditions  
**Ans:Post-processing and interpreting results**
- 4 32 What is the purpose of applying boundary conditions?  
 (a) To make the problem more complex (b) To ensure the structure is stable and has a unique solution  
 (c) To increase the number of elements (d) To calculate the element stiffness  
**Ans:To ensure the structure is stable and has a unique solution**
- 4 33 The functions which define the displacement at any point within an element are called...  
 (a) Stress functions (b) Strain functions  
 (c) Shape functions (d) Load functions  
**Ans:Shape functions**
- 4 34 "Assembling" the global stiffness matrix involves...  
 (a) Adding all element stiffness matrices together randomly (b) Summing the contributions of individual element stiffness matrices into the correct locations in the global matrix  
 (c) Multiplying all element stiffness matrices (d) Inverting the element stiffness matrices  
**Ans:Summing the contributions of individual element stiffness matrices into the correct locations in the global matrix**
- 4 35 The displacement  $u(x)$  in a linear spar element varies...  
 (a) Linearly (b) Quadratically  
 (c) Cubically (d) As a constant  
**Ans:Linearly**
- 4 36 The stiffness matrix for a 2D truss element depends on its...  
 (a) Length and Area (b) Material property E  
 (c) Orientation angle (d) All of the above  
**Ans:All of the above**
- 4 37 What is the primary unknown quantity calculated in a static structural FEM analysis?  
 (a) Stresses (b) Strains  
 (c) Nodal displacements (d) Reaction forces  
**Ans:Nodal displacements**
- 4 38 The FEM is best suited for solving problems with...  
 (a) Simple geometries and loads (b) Complex geometries, loads, and material properties  
 (c) Only linear materials (d) Only static loads  
**Ans:Complex geometries, loads, and material properties**
- 4 39 Aspect ratio in a mesh refers to the ratio of...  
 (a) The number of nodes to elements (b) The longest side to the shortest side of an element  
 (c) The element area to the total area (d) The element stiffness to global stiffness  
**Ans:The longest side to the shortest side of an element**
- 4 40 The element stiffness matrix is always a...  
 (a) Row vector (b) Column vector  
 (c) Square matrix (d) Rectangular matrix  
**Ans:Square matrix**

**U.NO Q NO****QUESTIONS**

- 4 41 If the length ( $L$ ) of a spar element is doubled, its stiffness ( $AE/L$ ) will be...  
(a) Doubled (b) Halved  
(c) Quadrupled (d) Unchanged  
**Ans:Halved**
- 4 42 If the Young's Modulus ( $E$ ) of a material is increased, the spar element's stiffness will...  
(a) Decrease (b) Increase  
(c) Remain the same (d) Become zero  
**Ans:Increase**
- 4 43 A plane truss is an assembly of spar elements that are joined by...  
(a) Welded joints (b) Rigid joints  
(c) Pin joints (hinges) (d) Bolted joints  
**Ans:Pin joints (hinges)**
- 4 44 The forces calculated at fixed supports after solving the problem are called...  
(a) Applied loads (b) Internal forces  
(c) Reaction forces (d) Nodal forces  
**Ans:Reaction forces**
- 4 45 The principle of minimum potential energy is a concept from...  
(a) Variational methods (b) Direct methods  
(c) Weighted residual methods (d) Finite difference methods  
**Ans:Variational methods**
- 4 46 The number of nodes in an element determines the...  
(a) Material of the element (b) Order of the polynomial used for shape functions  
(c) Length of the element (d) Force on the element  
**Ans:Order of the polynomial used for shape functions**
- 4 47 The process of enforcing zero displacement at a support node is a type of...  
(a) Load condition (b) Boundary condition  
(c) Initial condition (d) Material property  
**Ans:Boundary condition**
- 4 48 The strain in a linear 1D spar element is...  
(a) Zero (b) Constant  
(c) Varies linearly (d) Varies quadratically  
**Ans:Constant**
- 4 49 The stress in a quadratic 1D spar element...  
(a) Is constant (b) Varies linearly  
(c) Varies quadratically (d) Is zero  
**Ans:Varies linearly**
- 4 50 A "convergence study" in FEM involves...  
(a) Checking if the results are correct (b) Solving the problem with progressively finer meshes to see if the solution stabilizes  
(c) Making the mesh coarser (d) Changing the boundary conditions  
**Ans:Solving the problem with progressively finer meshes to see if the solution stabilizes**



U.NO	Q NO	QUESTIONS	
5	11	The stiffness matrix [K] for a beam element relates the nodal forces and moments to the nodal... (a) Stresses and strains (c) Axial forces	(b) Displacements and slopes (d) Temperatures
		<b>Ans:Displacements and slopes</b>	
5	12	What is the size of the element stiffness matrix for a 1D beam element? (a) 2x2 (c) 4x4	(b) 3x3 (d) 6x6
		<b>Ans:4x4</b>	
5	13	The stiffness of a beam element is proportional to its... (a) Length (L) (c) Cross-sectional area (A)	(b) Young's Modulus (E) and Area Moment of Inertia (I) (d) Density ( $\rho$ )
		<b>Ans:Young's Modulus (E) and Area Moment of Inertia (I)</b>	
5	14	What does 'I' represent in the term 'EI' for a beam? (a) Inertia (c) Identity matrix	(b) Internal force (d) Area Moment of Inertia
		<b>Ans:Area Moment of Inertia</b>	
5	15	If the length (L) of a beam element is doubled, its stiffness will... (a) Decrease by a factor of 2 (c) Increase by a factor of 2	(b) Decrease by a factor of 8 (d) Increase by a factor of 4
		<b>Ans:Decrease by a factor of 8</b>	
5	16	If the height of a rectangular beam's cross-section is doubled, its Area Moment of Inertia (I) increases by a factor of... (a) 2 (c) 8	(b) 4 (d) 16
		<b>Ans:8</b>	
5	17	The load vector for a beam element contains... (a) Nodal forces only (c) Both nodal forces and moments	(b) Nodal moments only (d) Internal shear forces
		<b>Ans:Both nodal forces and moments</b>	
5	18	What is a point load? (a) A load distributed over a length (c) A load that changes with time	(b) A load acting at a single point (d) The weight of the beam itself
		<b>Ans:A load acting at a single point</b>	
5	19	What does UDL stand for? (a) Unique Directional Load (c) Unbalanced Directional Load	(b) Uniformly Distributed Load (d) User-Defined Load
		<b>Ans:Uniformly Distributed Load</b>	
5	20	The units of a UDL are typically... (a) N (c) N/m	(b) N-m (d) N/m <sup>2</sup>
		<b>Ans:N/m</b>	

U.NO	Q NO	QUESTIONS
5	21	<p>How are distributed loads (like UDL) handled in FEM?</p> <p>(a) They are ignored (b) They are applied directly to the stiffness matrix</p> <p>(c) They are converted into equivalent nodal forces and moments (d) They are converted into stresses</p> <p><b>Ans:They are converted into equivalent nodal forces and moments</b></p>
5	22	<p>For a UDL 'q' over a beam element of length L, what is the equivalent nodal force at each end?</p> <p>(a) qL (b) qL/2</p> <p>(c) qL/6 (d) qL/12</p> <p><b>Ans:qL/2</b></p>
5	23	<p>For a UDL 'q' over a beam element of length L, what is the equivalent nodal moment at each end?</p> <p>(a) qL<sup>2</sup>/2 (b) qL<sup>2</sup>/8</p> <p>(c) qL<sup>2</sup>/12 (d) qL<sup>2</sup>/24</p> <p><b>Ans:qL<sup>2</sup>/12</b></p>
5	24	<p>The primary unknowns to be solved in a beam analysis are the...</p> <p>(a) Stresses and strains (b) Applied loads</p> <p>(c) Nodal displacements and rotations (d) Reaction forces and moments</p> <p><b>Ans:Nodal displacements and rotations</b></p>
5	25	<p>A cantilever beam is defined by which boundary condition?</p> <p>(a) Pinned at both ends (b) Fixed at one end, free at the other</p> <p>(c) Pinned at one end, roller at the other (d) Roller support at both ends</p> <p><b>Ans:Fixed at one end, free at the other</b></p>
5	26	<p>At a 'fixed' support in a beam model, what are the values of the DOFs?</p> <p>(a) v=0, <math>\theta</math> is unknown (b) v is unknown, <math>\theta=0</math></p> <p>(c) v=0, <math>\theta=0</math> (d) Both v and <math>\theta</math> are unknown</p> <p><b>Ans:v=0, <math>\theta=0</math></b></p>
5	27	<p>At a 'pinned' or 'hinged' support, what are the boundary conditions?</p> <p>(a) v=0, <math>\theta=0</math> (b) v is unknown, <math>\theta=0</math></p> <p>(c) v=0, <math>\theta</math> is unknown (d) Both v and <math>\theta</math> are unknown</p> <p><b>Ans:v=0, <math>\theta</math> is unknown</b></p>
5	28	<p>After finding nodal displacements and slopes, what can be calculated next?</p> <p>(a) Bending moment and shear force (b) The applied loads</p> <p>(c) The beam's length (d) The beam's material</p> <p><b>Ans:Bending moment and shear force</b></p>
5	29	<p>The bending moment in a beam is related to the...</p> <p>(a) First derivative of displacement (b) Second derivative of displacement</p> <p>(c) Third derivative of displacement (d) Fourth derivative of displacement</p> <p><b>Ans:Second derivative of displacement</b></p>
5	30	<p>The shear force in a beam is related to the...</p> <p>(a) First derivative of displacement (b) Second derivative of displacement</p> <p>(c) Third derivative of displacement (d) Fourth derivative of displacement</p> <p><b>Ans:Third derivative of displacement</b></p>

U.NO	Q NO	QUESTIONS
5	31	The total DOFs of a beam are ( $v_1, \theta_1, v_2, \theta_2$ ). This vector is often denoted by... (a) $\{F\}$ (b) $\{d\}$ or $\{u\}$ (c) $\{K\}$ (d) $\{\sigma\}$ <b>Ans: <math>\{d\}</math> or <math>\{u\}</math></b>
5	32	The flexural rigidity of a beam is a measure of its... (a) Resistance to axial load (b) Resistance to twisting (c) Resistance to bending (d) Resistance to shear <b>Ans: Resistance to bending</b>
5	33	A point load 'P' is applied at the center of a beam element of length L. The equivalent nodal forces are... (a) P at each node (b) P/2 at each node (c) P/4 at each node (d) P/L at each node <b>Ans: P/2 at each node</b>
5	34	A point load 'P' is applied at the center of a beam element of length L. The equivalent nodal moments are... (a) PL/2 (b) PL/4 (c) PL/8 (d) PL/12 <b>Ans: PL/8</b>
5	35	In FEM, a simply supported beam has which supports? (a) Fixed-Fixed (b) Fixed-Free (c) Pinned-Roller (d) Pinned-Pinned <b>Ans: Pinned-Roller</b>
5	36	The derivative of the shape function N2 (for $\theta_1$ ) must be... (a) 1 at node 1, 0 at node 2 (b) 0 at node 1, 1 at node 2 (c) 0 at both nodes (d) 1 at both nodes <b>Ans: 1 at node 1, 0 at node 2</b>
5	37	The terms in a beam stiffness matrix have units of... (a) Force, Moment, Force/Length (b) N, N-m, N/rad (c) N/m, N, N-m (d) All of the above are correct <b>Ans: All of the above are correct</b>
5	38	If a UDL is applied to only half of a beam element, the equivalent nodal load vector will be... (a) Symmetric (b) The same as a full UDL (c) Asymmetric (d) Zero <b>Ans: Asymmetric</b>
5	39	The reaction forces in a beam problem are found... (a) Before solving for displacements (b) By looking them up in a table (c) After solving for displacements, using the $\{F\}=[K]\{d\}$ equation (d) They are always zero <b>Ans: After solving for displacements, using the <math>\{F\}=[K]\{d\}</math> equation</b>
5	40	A beam element is a _____ element. (a) Spar (b) Bar (c) Truss (d) Flexural <b>Ans: Flexural</b>

U.NO	Q NO	QUESTIONS
5	41	The stiffness matrix for a beam element is... (a) Always symmetric (b) Always diagonal (c) Always singular (d) Always an identity matrix <b>Ans:Always symmetric</b>
5	42	The total vertical force in the equivalent nodal load vector for a UDL 'q' on a beam of length L must equal... (a) $qL/2$ (b) $qL$ (c) $qL^2/8$ (d) $qL^2/12$ <b>Ans:qL</b>
5	43	The slope of the beam's deflection curve is represented by... (a) $v$ (b) $dv/dx$ (or $\theta$ ) (c) $d^2v/dx^2$ (d) $d^3v/dx^3$ <b>Ans:dv/dx (or <math>\theta</math>)</b>
5	44	A beam element assumes that plane sections... (a) Remain plane and perpendicular to the neutral axis after bending (b) Distort into curved surfaces (c) Do not move (d) Rotate freely <b>Ans:Remain plane and perpendicular to the neutral axis after bending</b>
5	45	A beam with a very high value of 'I' (Area Moment of Inertia) will be... (a) Very flexible (b) Very stiff against bending (c) Very light (d) Very weak <b>Ans:Very stiff against bending</b>
5	46	What is the main purpose of converting a distributed load to a work-equivalent nodal load vector? (a) To simplify the math (b) To ensure the work done by the nodal loads is the same as the work done by the distributed load (c) To make the beam stiffer (d) To reduce the number of DOFs <b>Ans:To ensure the work done by the nodal loads is the same as the work done by the distributed load</b>
5	47	Where is the bending stress in a beam's cross-section typically the highest? (a) At the neutral axis (b) At the top and bottom surfaces (c) It is constant everywhere (d) At the geometric center <b>Ans:At the top and bottom surfaces</b>
5	48	The displacement 'v' within a beam element is a function of... (a) The nodal forces $F_1$ and $F_2$ (b) The nodal displacements and slopes ( $v_1, \theta_1, v_2, \theta_2$ ) (c) The element length $L$ (d) The material $E$ <b>Ans:The nodal displacements and slopes (<math>v_1, \theta_1, v_2, \theta_2</math>)</b>
5	49	The Area Moment of Inertia (I) depends on the... (a) Length of the beam (b) Material of the beam (c) Geometry of the beam's cross-section (d) Loads on the beam <b>Ans:Geometry of the beam's cross-section</b>
5	50	A continuous beam over multiple supports is best modeled in FEM using... (a) A single beam element (b) Multiple beam elements, one between each support (c) Spar elements (d) Solid elements <b>Ans:Multiple beam elements, one between each support</b>

## UNIT – I

### **PART B** (Short answer questions each question carries 3 marks)

- 1 Write about DDA line drawing algorithm in brief.
- 2 Write about 2D rotation about the origin with its transformation matrix.
- 3 What are composite transformations? Give an example.
- 4 Differentiate between a Window and a Viewport with a diagram.
- 5 Discuss the benefits of using homogeneous coordinates.
- 6 Write the transformation matrix for 3D rotation about the Z-axis.
- 7 Describe the concept of line clipping.
- 8 How is an ellipse defined? Write its standard equation.
- 9 What is the core idea behind the Midpoint Circle (Beckenhams/Bresenham's) algorithm?
- 10 List three major applications of Computer Graphics.

## UNIT – II

### **PART B** (Short answer questions each question carries 3 marks)

- 11 Compare Wireframe, Surface, and Solid modelling.
- 12 Discuss the properties of a Bezier curve with a simple sketch.
- 13 Enumerate the advantages of B-Spline curves over Bezier curves.
- 14 Write the parametric equation for a line segment between points  $P_1(x_1, y_1)$  and  $P_2(x_2, y_2)$ .
- 15 Discuss the concept of continuity ( $C_0, C_1, C_2$ ) for curves.
- 16 What is a ruled surface? Give an example.
- 17 How is the degree of a Bezier curve determined?
- 18 Discuss why solid models are preferred for engineering analysis.
- 19 What is a knot vector in a B-spline?
- 20 What is interpolation vs. approximation in curve fitting?

## UNIT – III

### **PART B** (Short answer questions each question carries 3 marks)

- 21 Compare Boundary Representation (B-Rep) and Constructive Solid Geometry (CSG).
- 22 Discuss the structure of a CSG binary tree with a simple example.
- 23 Verify Euler's formula for a simple cube.
- 24 Discuss the two types of sweep operations: Extrude and Revolve.
- 25 What are the advantages of B-Rep modelling?
- 26 What are the advantages of CSG modelling?

- 27 What is a manifold model in B-Rep?
- 28 Write the Union Boolean operation with a simple sketch.
- 29 How is solid modelling used in Rapid Prototyping (3D Printing)?
- 30 Discuss how Euler operators are used in B-Rep modelling.

## UNIT – IV

### PART C *(Short answer questions each question carries 3 marks)*

- 31 List the general steps involved in Finite Element Analysis.
- 32 Discuss the concept of discretization with a simple sketch.
- 33 Derive the element stiffness matrix for a 1D linear spar element.
- 34 Differentiate between 1D, 2D, and 3D elements with examples.
- 35 Compare a linear spar element and a quadratic spar element.
- 36 How does a plane truss element differ from a 1D spar element in its formulation?
- 37 Describe the physical meaning of the terms in a simple 2x2 stiffness matrix.
- 38 Why is it necessary to apply boundary conditions before solving the system of equations?
- 39 What is the principle of minimum potential energy?
- 40 Differentiate between nodal loads and element loads.

## UNIT – V

### PART B *(Short answer questions each question carries 3 marks)*

- 41 Differentiate between a spar element and a beam element in detail.
- 42 Discuss the degrees of freedom for a 2D beam element with a neat sketch.
- 43 Why are cubic Hermite polynomials necessary for beam element shape functions?
- 44 Describe how a uniformly distributed load (UDL) on a beam element is converted to equivalent nodal loads.
- 45 Write down the element stiffness matrix for a 2D beam element.
- 46 What is a cantilever beam? How would you apply boundary conditions for it in FEM?
- 47 What is a simply supported beam? How would you apply boundary conditions for it?
- 48 List the four properties that Hermite shape functions (N1, N2, N3, N4) must satisfy.
- 49 Describe how to form the load vector for a beam element with a point load P at its center.
- 50 What are the main assumptions made in the simple theory of bending for beams?

## **UNIT – I**

### **PART C**      *(Explanatory type questions each question carries 10 marks)*

- 1 What are graphic primitives? List and explain any three basic graphic primitives used in computer graphics.
- 2 Explain the transformation matrices for translation, scaling, and rotation in 2D graphics.
- 3 Explain the procedure involved in the Digital Differential Analyzer (DDA) line drawing algorithm.
- 4 Write about Bresenham's line generation algorithm with an example.  
Explain the process of window-to-viewport mapping with suitable diagrams. Discuss the
- 5 importance of viewport transformation.

## **UNIT – II**

### **PART C**      *(Explanatory type questions each question carries 10 marks)*

- 6 Explain about geometric modelling and state its importance in engineering.
- 7 What is surface modeling? Explain the types of surfaces used in modeling.  
What is a Bezier curve? Write down its basic equation and explain its role in computer-aided
- 8 design.
- 9 What is a cubic spline? Explain its significance in curve fitting with an example.
- 10 Compare Wireframe, Surface and Solid modeling.

## **UNIT – III**

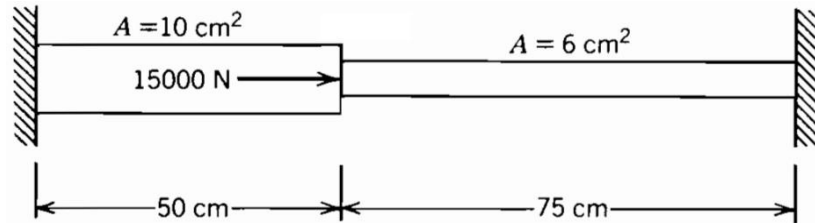
### **PART C**      *(Explanatory type questions each question carries 10 marks)*

- 11 Explain the fundamentals of solid modeling and its importance in engineering design.
- 12 Describe the boundary representation (B-Rep) method in solid modeling. State its advantages and limitations.
- 13 Describe the Constructive Solid Geometry (CSG) method in solid modeling. State its advantages and limitations.
- 14 Explain the binary tree with neat sketch.
- 15 Explain the Euler's Equation used in solid modeling using an example

## UNIT – IV

### PART C (Explanatory type questions each question carries 10 marks)

- 16 Explain the general procedure of FEM with all steps involved in solving an engineering problem.
- 17 Formulate the element stiffness matrix for a 1D linear spar element.
- 18 Calculate the axial force in each member of the structural system shown below using FEM. Take  $E = 20 \times 10^6 \text{ N/cm}^2$ .

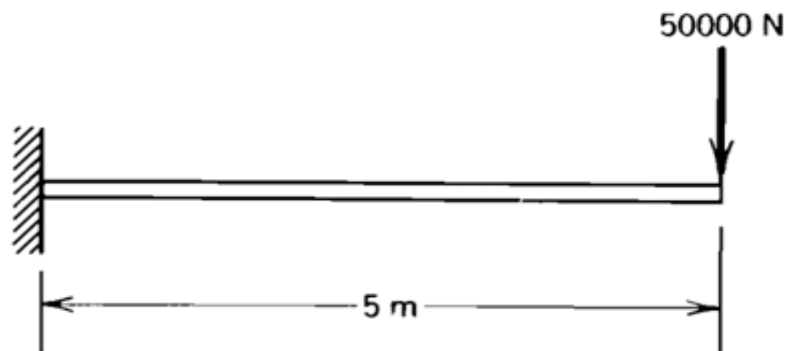


- 19 A steel rod of length 2 meters and cross-sectional area  $1000 \text{ mm}^2$  is fixed at one end and subjected to an axial load of 10 kN at the free end. The Young's modulus of the material is  $200 \text{ kN/mm}^2$ . Discretize the rod into two equal elements and determine the nodal displacements using the Finite Element Method.
- 20 Explain about Solid manipulators.

## UNIT – V

### PART B (Explanatory type questions each question carries 10 marks)

- 21 Explain about Hermite shape functions.
- 22 Formulate the element stiffness matrix for a one-dimensional beam element.
- 23 Determine the slope and deflection at the free end of the beam shown below using a single 1D beam element. Take  $E = 20 \times 10^6 \text{ N/cm}^2$  and  $I = 8000 \text{ cm}^4$ .



- 24 A cantilever beam of length 2 m is subjected to a UDL of 4 kN/m along its entire length. Using a single beam element, determine the equivalent nodal force vector.
- 25 Explain about plane stress and plane strain elements.