Eighth Semester B. E. Mech And Sixth Semester B. E. Mech (P. T) Examination

COMPUTER AIDED DESIGN

Time : Three Hours] [Max. Marks : 80

N. B. :
(1) Separate answer book must be used for each section
(2) All questions carry marks as indicated.
(3) Answer **Three** questions from Section A and **Three** questions from Section B.
(4) Assume suitable data wherever necessary.
(5) Illustrate your answer wherever necessary with the help of neat sketches.
(6) Use of non programable calculator is permitted.

SECTION A

1. (a) Explain in brief the various CAD module. 7

   (b) Explain in brief basic functional capabilities required in any CAD package like geometry generator, size generator and geometry modifier. 6

2. (a) Explain the Bresenham's circle drawing algorithm in Ist quadrant. Also show the pixel movement for circle with radius equal to 3 unit for Ist quadrant on graph paper. 8

   (b) Explain in brief various types of shear transformation with example. 5

3. (a) Reflect the triangle ΔABC about the line $3x-4y+8=0$ The position vector of the coordinate ABC is given as A [4, 1]; B[5, 2]; C [4, 3]. 8

(b) A circle with radius r = 8cm, centre [11, 9] is to be converted into an ellipse with major axis a = 11 cm and minor axis b=9 cm. Find the total transformation matrix. 5

4. (a) Given a bezier curve with 4 control point B_0 [1, 0], B_1[3, 3]; B_2[6, 3], B_3 [8, 1] determine any five points lying on the curve. Also draw the rough sketch of curve. 10

(b) Give a 3 x 3 homogeneous coordimate transformation matrix for following translation.

(i) Translate the image up 2 units.

(ii) Move the image down 2/3 units and left 4 units. 4

5. (a) A homogenous coordinate [3, 2, 1, 1] is translated in the x, y, z directions by –2, –2, –2 respectively; followed sucessively by a 45^0 rotation about y axis and 60^0 rotation about x–axis. Find the final position of homegeneous coordinate. 9

(b) Differentiate between surface and solid modelling. 4

SECTION B

6. (a) Explain in brief the various types a of elements with their salient features. 4

(b) Explain in brief the basic steps of FEM. 5

(c) What is shape function ? What are its prerequisites ? 4

7. For the component shown in fig [7], determine

(i) Nodal displacement [Neglect self weight]

(ii) Stresses in element

(iii) Reaction

$E = 2 \times 10^5 MPa$

$P_1 = 10kN$

$P_2 = 8\ kN$

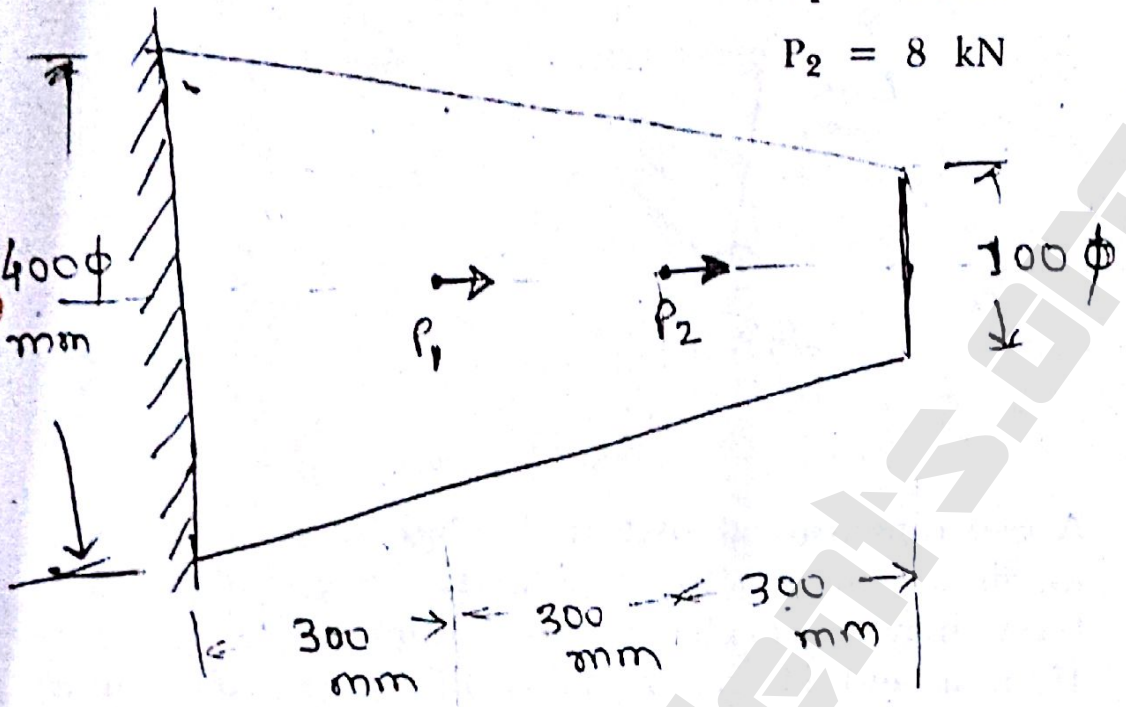


Fig. 7 13

8. A truss shown in fig [8] with cross section area of all elements equal to 250 mm^2 and Youngs modulus $E = 2 \times 10^5$ MPa

   (i) Determine the element stiffness matrix for each element.

   (ii) Assemble the structural [global] stiffness matrix for entire truss.

   (iii) Using elimination method find nodal displacement.

   (iv) Find the stresses in all element.

   (v) Calculate the reaction force.

Fig. on Page No 4

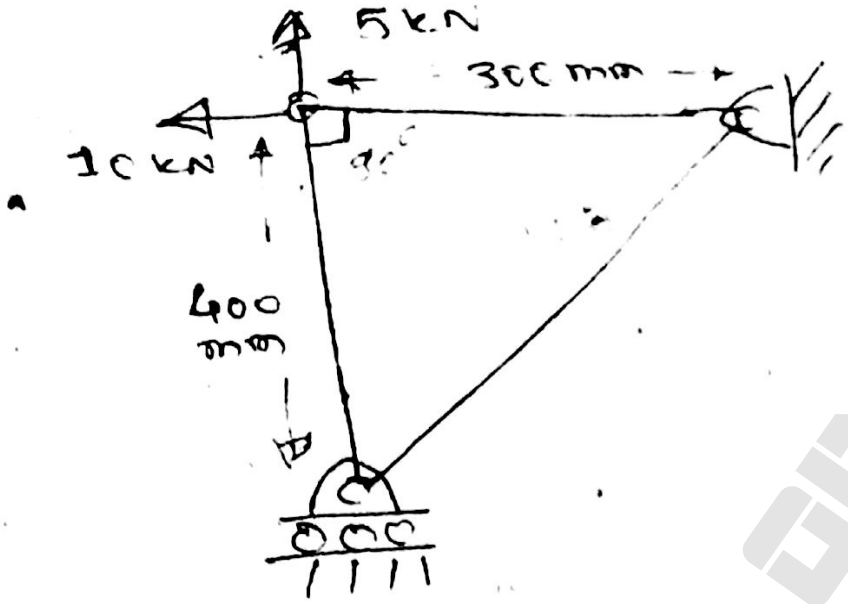


Fig [8] 13

9. A two dimensional plate is loaded by a 10 kN force as shown in fig [9]. The body force and fraction force may be neglected. The thickness of plate is 15 mm and elastic modulus $E = 2 \times 10^5$ N/mm^2 and Poisson ratio $\mu = 0.3$
Determine are nodal displacements using plane stress conditio

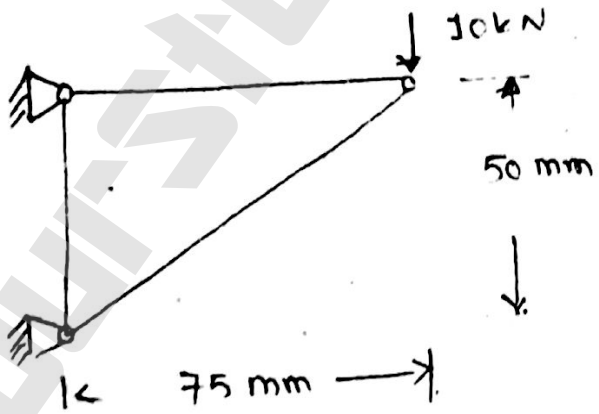


Fig. 9 13

10. Write short notes (any **three**) :—
(i) Bi section Method.
(ii) Simplex Search Method.
(iii) Penalty Function Method.
(iv) Golden Search Method. 14

SVK/KW/11/3407/3657

Faculty of Engineering & Technology

Eighth Semester B.E. (Mech.)/Sixth Semester B.E. P.T. (Mech.) Examination

COMPUTER AIDED DESIGN

Sections—A & B

Time : Three Hours] [Maximum Marks : 80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Answer **THREE** questions from Section A and **THREE** questions from Section B.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

(5) Use of Design data book and Calculator (non-programmable) is permitted.

SECTION—A

1. (a) Explain graphics, application and programming software module with reference to any commercial available CAD software. 8

(b) What is Frame Buffer ? Explain. 5

2. (a) Write Bresenham's Algorithm for a straight line and draw a line from (10, 10) to (15, 15). Plot the points on graph paper. 9

(b) Explain the concept of homogeneous coordinates in graphic transformation. 4

3. (a) Fig. 1 shows a circle with radius r = 50 mm. Centre 'A' [10, 10] is to be converted into an ellipse with major axis a = 90 mm and minor axis b = 60 mm. Find the total transformation matrix. 9

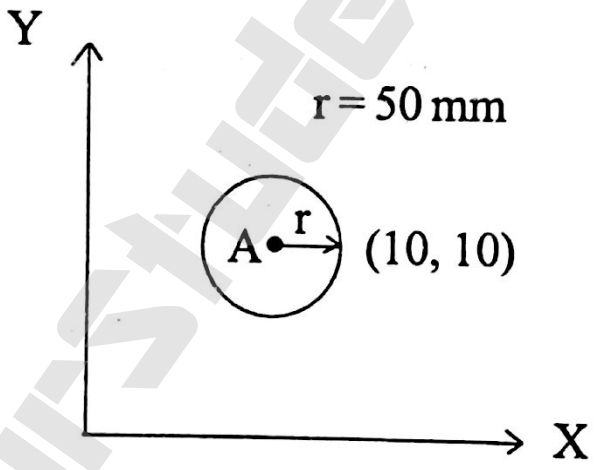


Fig. 1, Q. 3(a)

(b) What do you understand by Aspect ratio ? Explain how it used convert ellipse into circle. 4

4. (a) A triangle having vertices (2, 3), (6, 3) and (4, 8) is reflected about the line having equation

$y = 3x + 4$. Find the final position of the triangle using 2-D transformation. 8

(b) What is Bezier curve ? How it is defined ? Where it is used ? 6

5. (a) Explain the concept of following modelling technique in brief :

(i) Geometric Modelling

(ii) Solid Modelling

(iii) Wire Frame Modelling. 9

(b) Explain in brief shear transformation. 4

SECTION—B

6. (a) What are the various steps involved in FEM ? 7

(b) Explain in brief the types of element used in FEM alongwith their characteristics. 6

7. Figure 2 shows a thin plate having uniform thickness $t = 25$ mm. Modulus of elasticity $E = 2 \times 10^5$ N/mm^2. In addition to self weight it is subjected to two point loads as shown. The density $\rho = 7{\cdot}86 \times 10^{-6}$ gm/mm^3.

Model the plate with two one-dimensional elements and determine Stresses in each member. 13

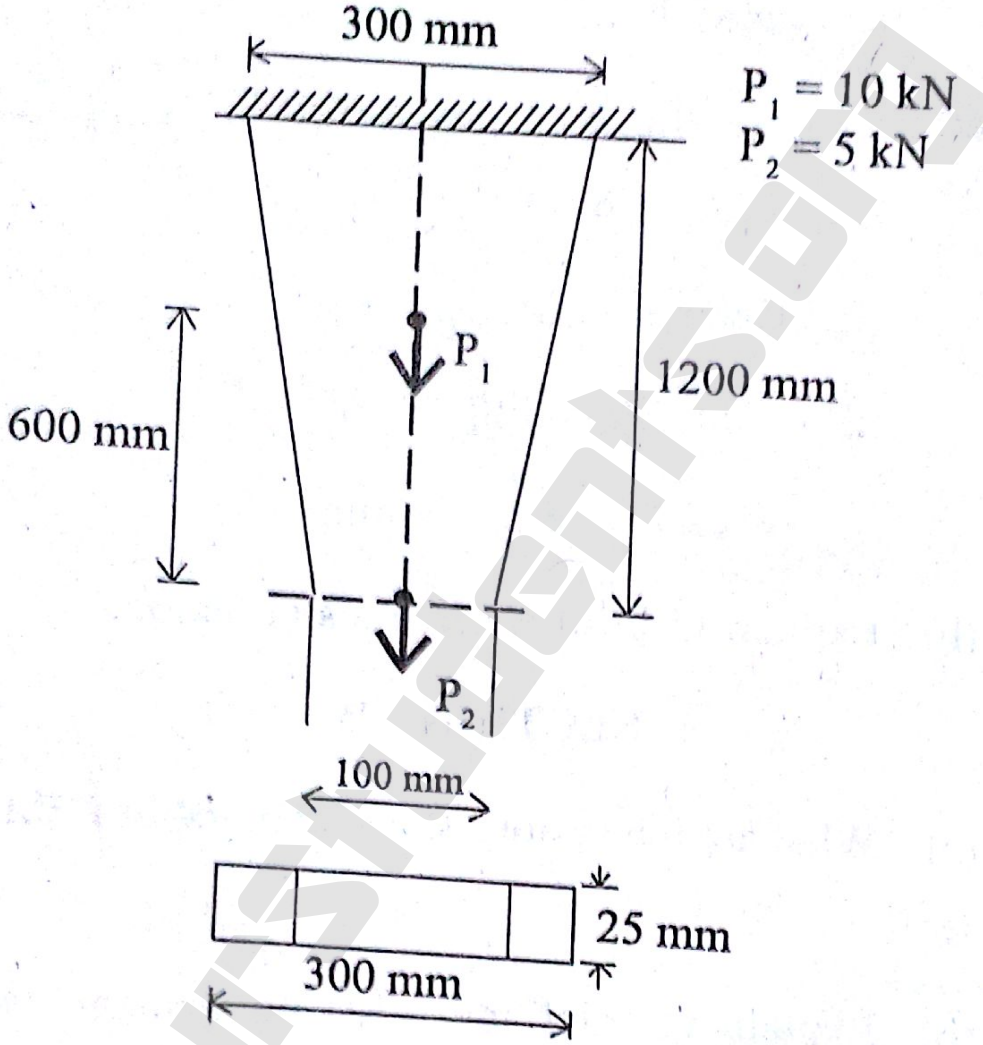


Fig. 2, Q. 7

8. For a pin joined truss shown in Fig. 3, treating each member as 1-D linear element, determine :

   (i) Stiffness matrix of each element

   (ii) Assembled global stiffness matrix

(iii) Displacement at nodes

(iv) Stresses in each member. 13

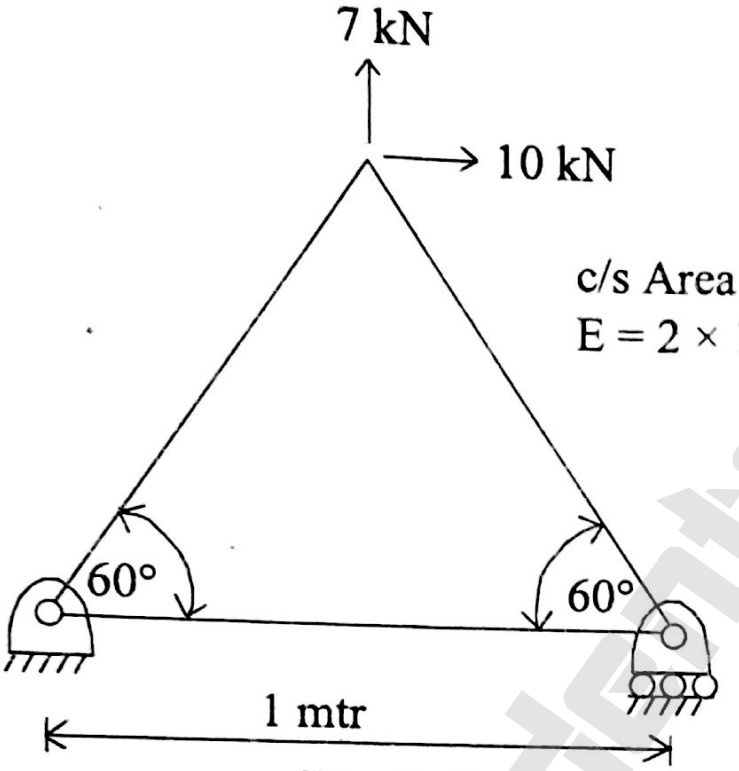


Fig. 3, Q. 8

9. Fig. 4 shows a two dimensional plate of thickness 20 mm. If load P = 10 kN is applied as shown in fig. determine the nodal displacement. 13

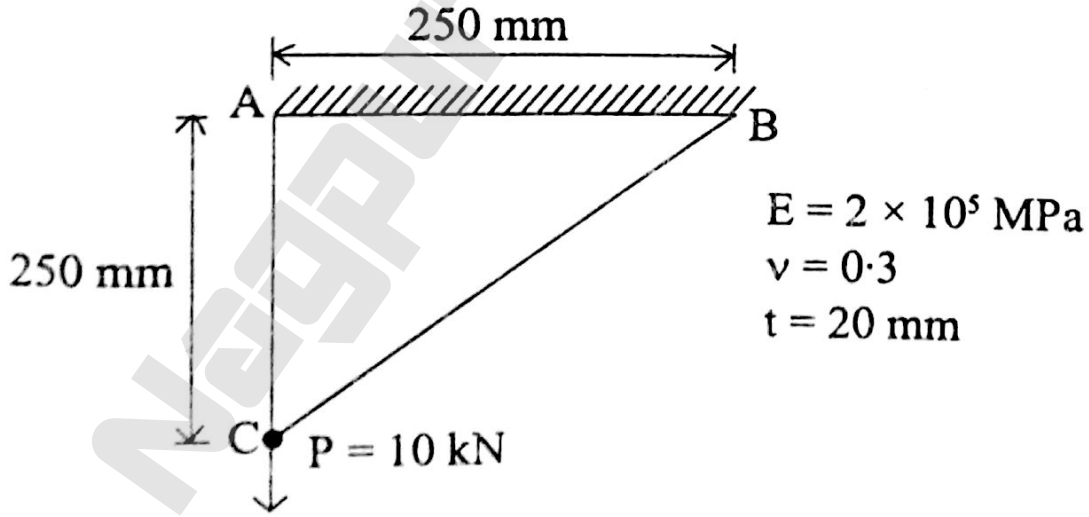


Fig. 4, Q. 9

10. (a) Explain Simplex Search Method for multivariable optimization. Also write the algorithm for the same. 7

(b) Explain with suitable example Bisection Method for single variable optimization. 7

SUMMER - 2012

COMPUTER AIDED DESIGN

SECTION – A

1. (a) Explain in brief the various applications of Computer Graphics. (8)

   (b) What is the difference between VGA and SVGA resolutions? (5)

2. (a) Write an algorithm for an ellipse. The equation of ellipse is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1. \quad (8)$$

   (b) Draw an ellipse for the first quadrant with a = 3 and b = 2 using ellipse algorithm. (5)

3. (a) Find a transformation of triangle A(1, 0), B(0, 1), C(1, 1) by:
   (i) Rotating 45° about the origin and then translating one unit in x and y directions resp.
   (ii) Translating one unit in x and y direction resp. and then rotating 45° about the origin.
   Comment on the resultant co-ordinates obtained in part (i) and (ii). (10)

   (b) Derive the transformation matrix for counter-clockwise rotation about the fixed pt. (x_c, y_c) (3)

4. (a) Find out the co-ordinates of a figure bounded by (0, 0); (1, 5); (6, 3); (–3, –4), when reflected along the line whose equation is y = 2x + 4 and sheared by 2 units in x direction and 2 units in y directions. (9)

   (b) Find out the final co-ordinates of a figure bounded by co-ordinates (1, 1); (3, 4); (5, 7); (10, 3), when rotated about a point (8, 8) by 30° in clockwise direction and scaled by 2 units in x and y direction respectively. (5)

5. (a) Construct the Bezier curve of order 3 and with 4 polygon vertices A(1, 1); B(2, 3); C(4, 3) and D(6, 4). Calculate the co-ordinates of points on the curve corresponding to the parameter :

$t = 0;\ 1/4;\ 1/2;\ 3/4$ (10)

(b) Differentiate between surface and solid modeling. (3)

SECTION – B

6. (a) Explain in brief the various approaches used to formulate element matrices. (6)

(b) For the spring assemblage shown in Fig. 6(b) obtain :

(i) the assembled stiffness matrix

(ii) the displacement of node 2 and 3

(iii) the reaction forces at node 1 and 4

(iv) the forces in each spring. (8)

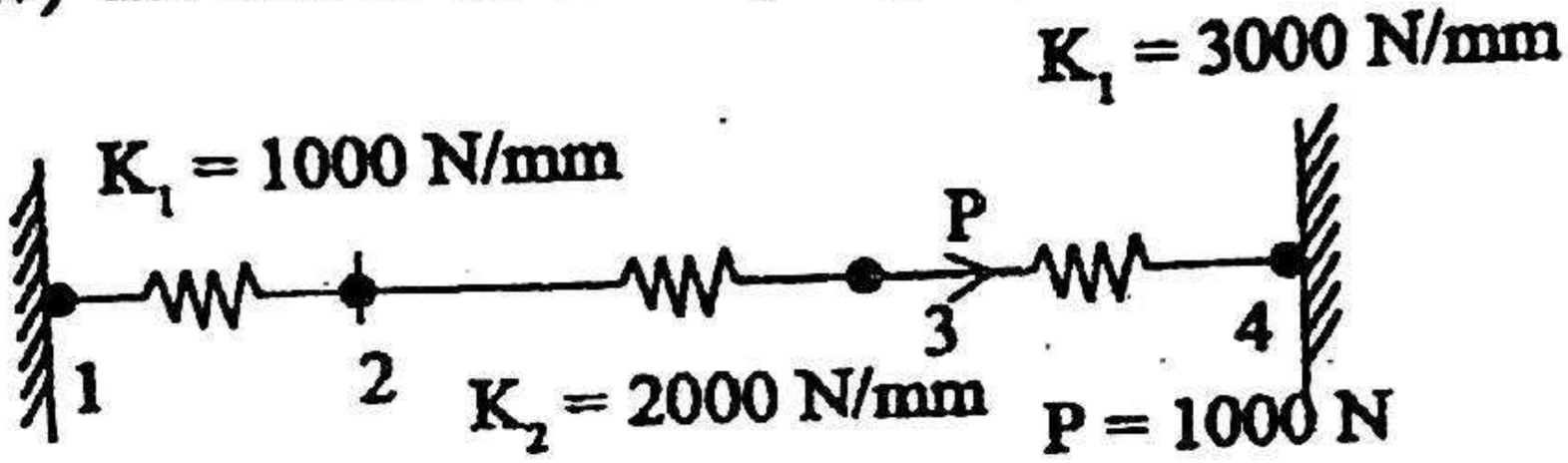


Fig. 6(b)

7. For the plane truss shown in Fig. 7, determine displacement at the nodes and stresss in members. Given cross sectional area of member = 200 mm^2 and Elastic constant $E = 2 \times 10^5\ N/mm^2$. (13)

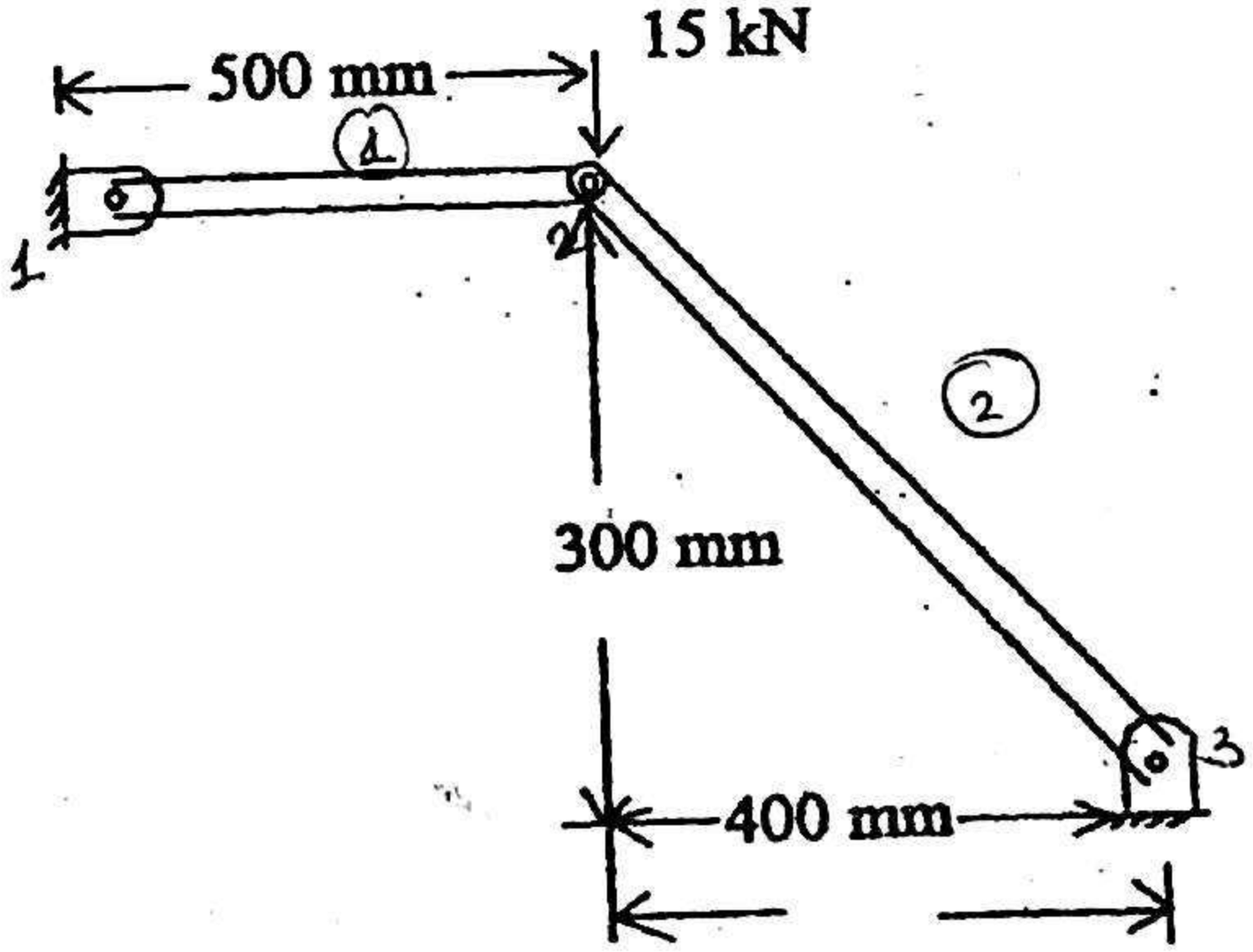
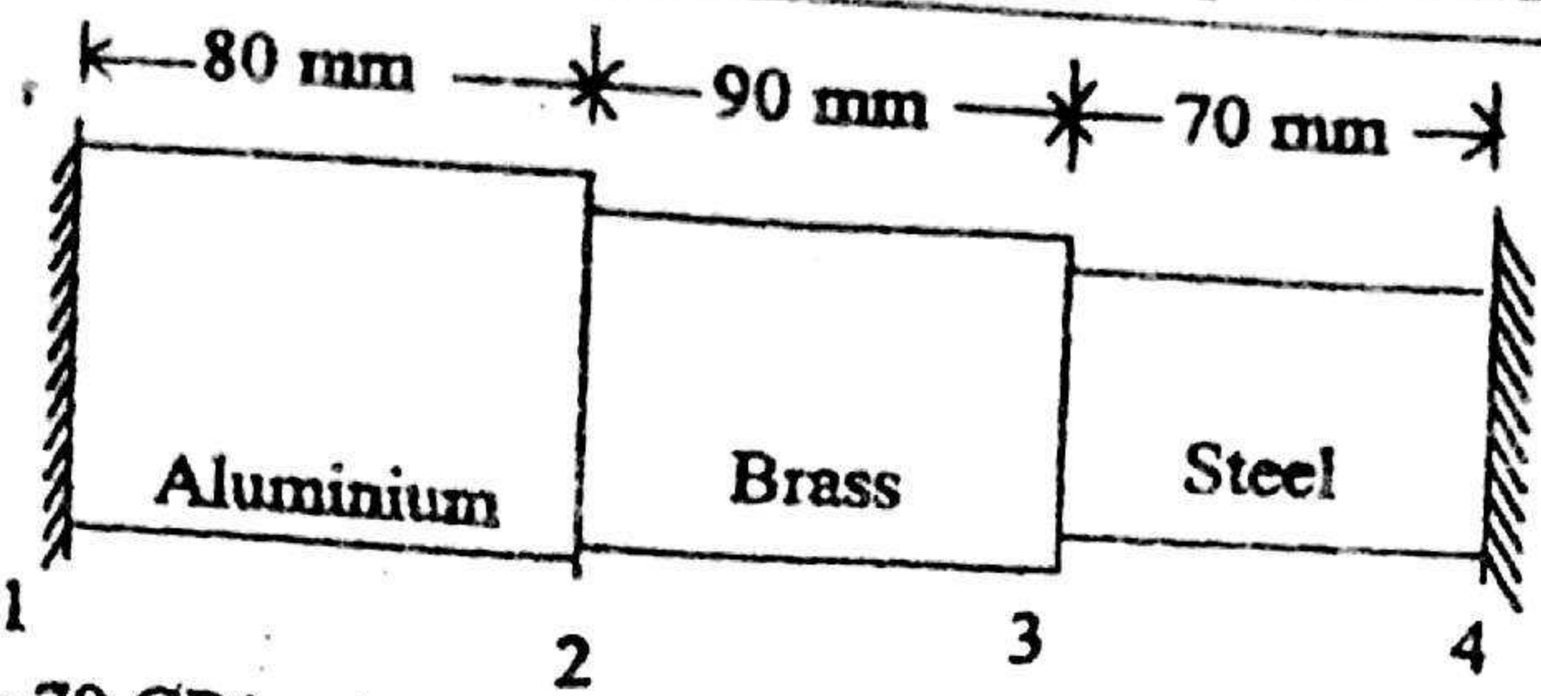


Fig. 7

8. (a) For the three stepped bar shown in Fig. 8, the bars fit snugly between the rigid walls at room temperature. The temperature is then raised by 40°C. Determine the displacements at 2 and 3 and the stresses in the three sections. (10)



E_{AL} = 70 GPA
A_{AL} = 900 mm²
α_{AL} = 23×10⁻⁶/°C

E_{Br} = 105 GPA
A_{Br} = 400 mm²
α_{Br} = 19×10⁻⁶/°C

E_{St} = 200 GPa
A_{St} = 200 mm²
α_{St} = 12×10⁻⁶/°C

Fig. 8

(b) What do you understand by shape function? Name the various shape functions used for one dimensional finite element modelling. (3)

9. A two dimensional plate shown in Fig. 9. The thickness of plate is 10 mm and elastic modulus $E = 2 \times 10^5$ MPa and Poisson ratio $\nu = 0.3$. Neglecting body force and traction force determine the nodal displacement using plane stress condition. (13)

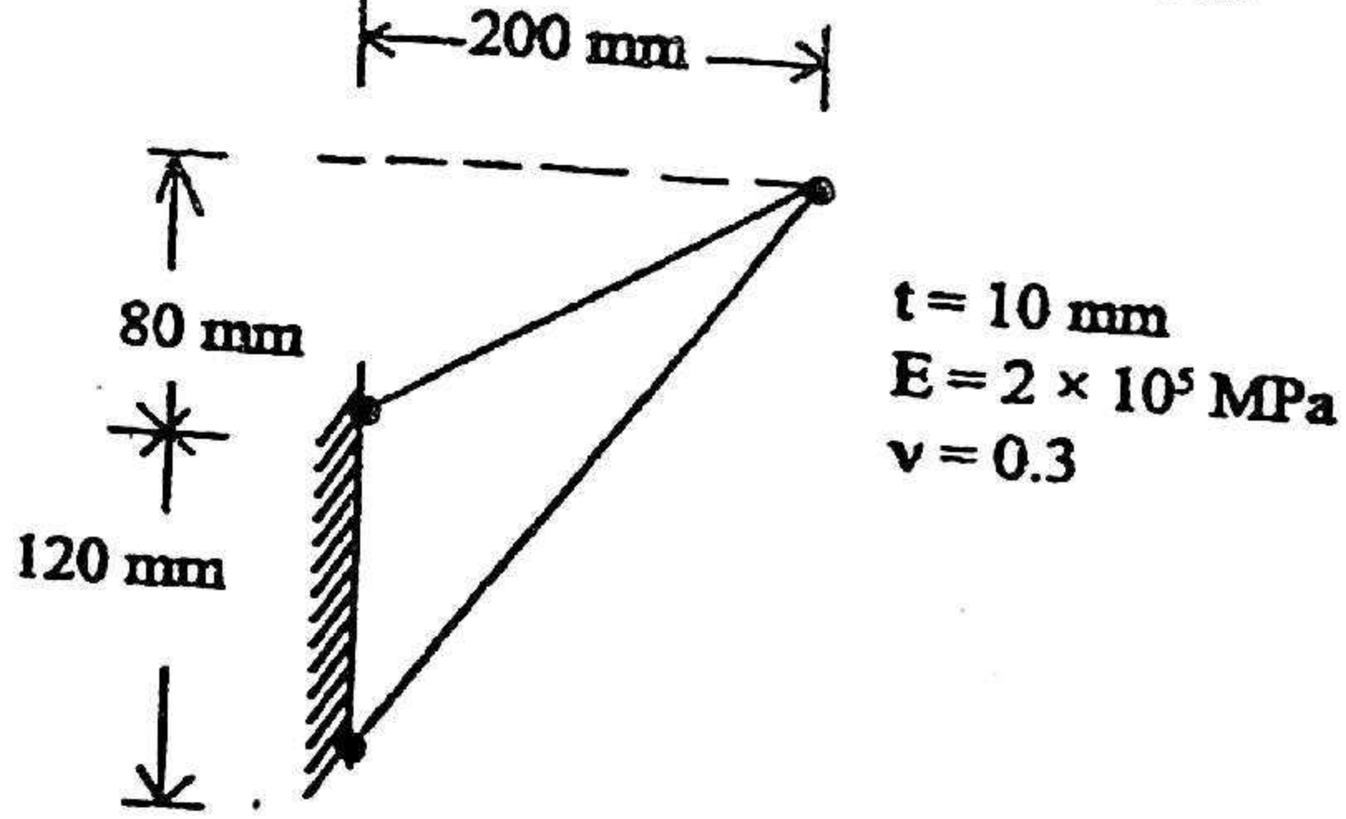


Fig. 9

10. Write short notes (any THREE) :–

(a) Golden search method

(b) Penalty function method

(c) Bisection method

(d) Hermite shape functions for beam element. (13)

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WINTER - 2012

COMPUTER AIDED DESIGN

SECTION – A

1. (a) Explain CAD software modules and its capabilities related to CAD. (6)

   (b) Differentiate raster scan and random scan display systems. (7)

2. (a) Explain and write Bresenham's mid-point algorithm for the generation of circle. (9)

   (b) What do you mean by homogeneous transformation and what is its need in concatenated transformation in case of 2-D transformation? (5)

3. (a) A triangle ABC is to be reflected about its side BC. Explain the steps required and determine the resultant transformation matrix A(2, 3), B(10, 8), C(–1, 10). (7)

   (b) A point 'P' has coordinates (10/5) with reference to XY Cartesian system. What will be the co-ordinates of point P with reference to X'Y' Cartesian system. Two Cartesian system are shown in Fig. Q.3(b) :

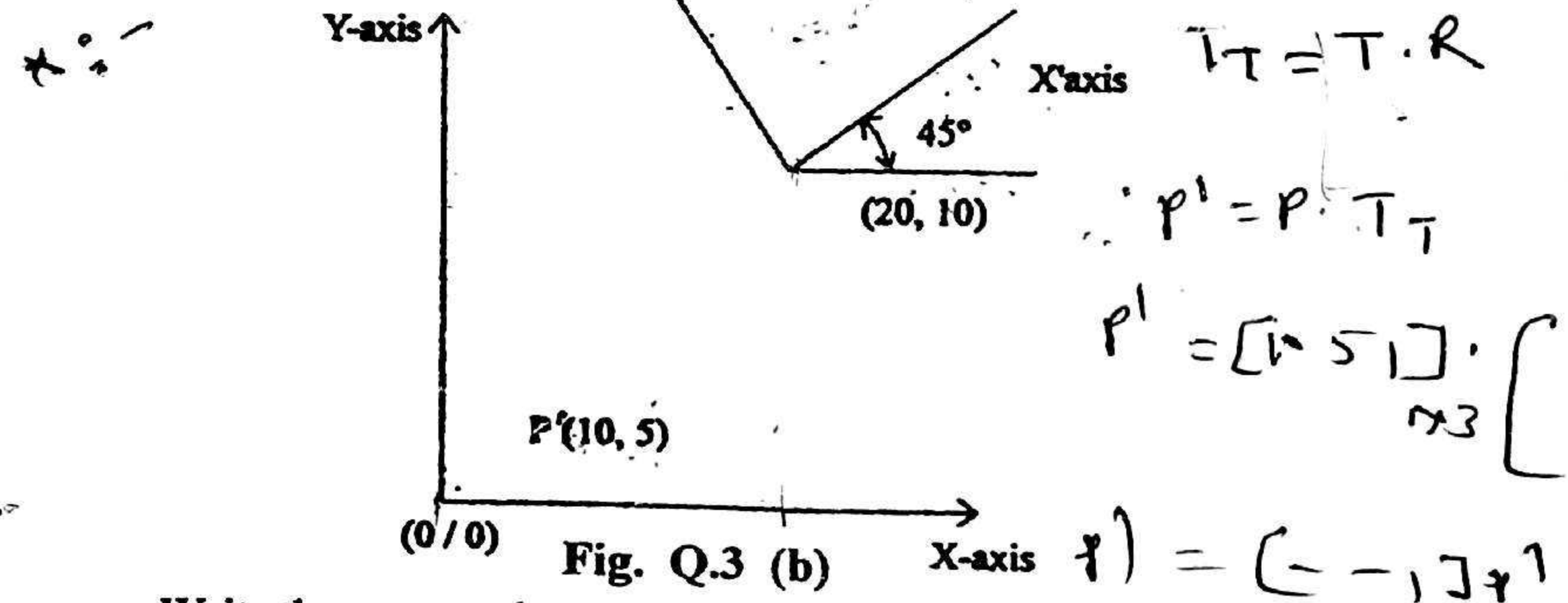


Fig. Q.3 (b)

   Write the steps and matrix for transformation between Cartesian coordinate systems. (6)

4. Explain and write the series of transformations required to rotate a point P(x, y, z) about an arbitary line in 3-D space. (13)
   (Sequence and individual transformation matrices are expected, total resultant transformation is not expected).

5. (a) Compare the two techniques of solid modeling CSG & B rep. techniques. (6)

(b) Explain 'Bezier curve' and write its basic properties. (7)

SECTION – B

6. (a) Explain the shape function for 1-D element bar element along with their salient features. (7)

(b) Explain basic steps of FEM. (6)

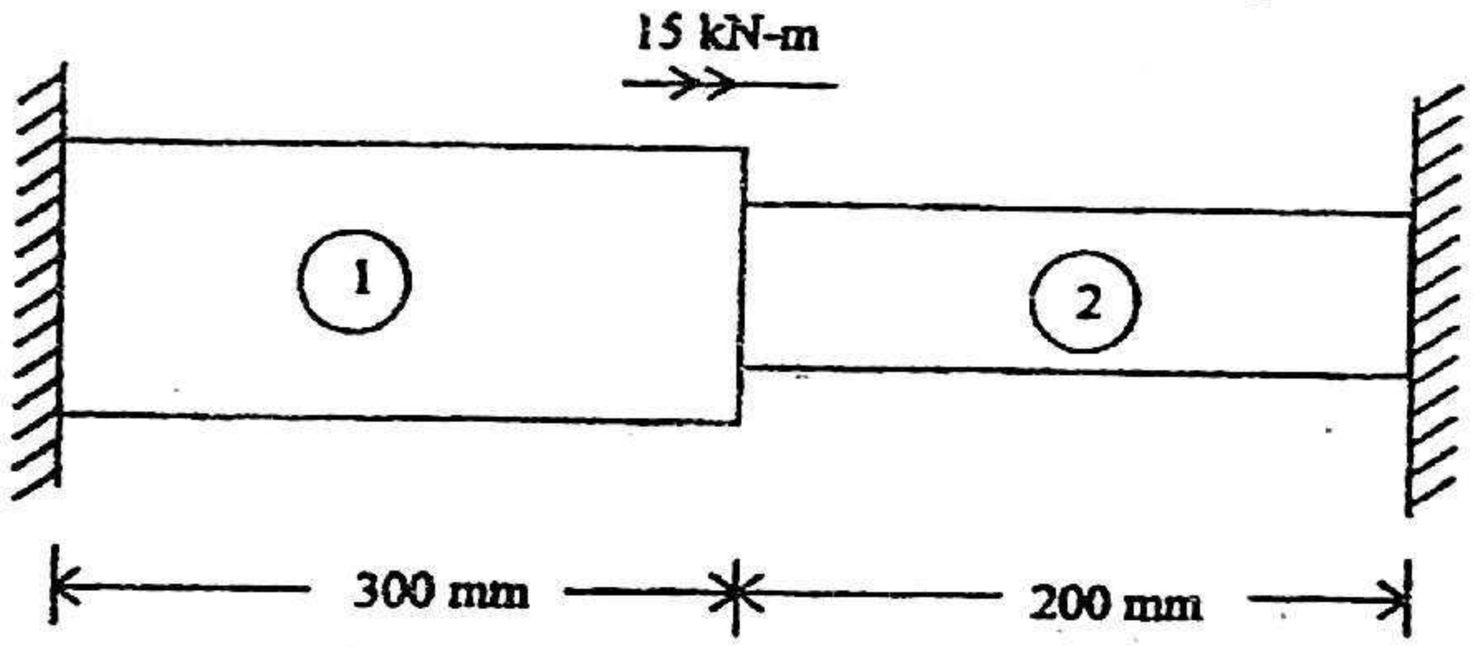
7. (a) Derive the stiffness matrix for one dimensional bar element defined by natural coordinates :

$$\xi = \frac{2(x - x_1)}{(x_2 - x_1)} - 1$$

having two nodes with shape functions

$$N_1 = \frac{1-\xi}{2} \quad \& \quad N_2 = \frac{1+\xi}{2}. \qquad (7)$$

(b) The stepped shaft shown in Fig. Q.7(b) is fully restrained against rotation at supports about its axis. Twisting moment of 15 kN-m is applied at the point of changing section. (7)



$J_1 = 3\times10^7$ mm^4, $J_2 = 2\times10^7$ mm^4.

Take G = 60×10^3 N/mm^2.

(not to scale)

Fig. Q.7(b)

8. Two-dimensional model of an anchor plate of a communication tower's guy cable is shown in the illustrative figure. The anchor consists of a triangular steel plate, which is subjected to force of 20 kN, as shown in Figure. Analyse the anchor plate. Thickness of the plate in 8 mm. Consider E = 200 GPa and ν = 0.3 (13)

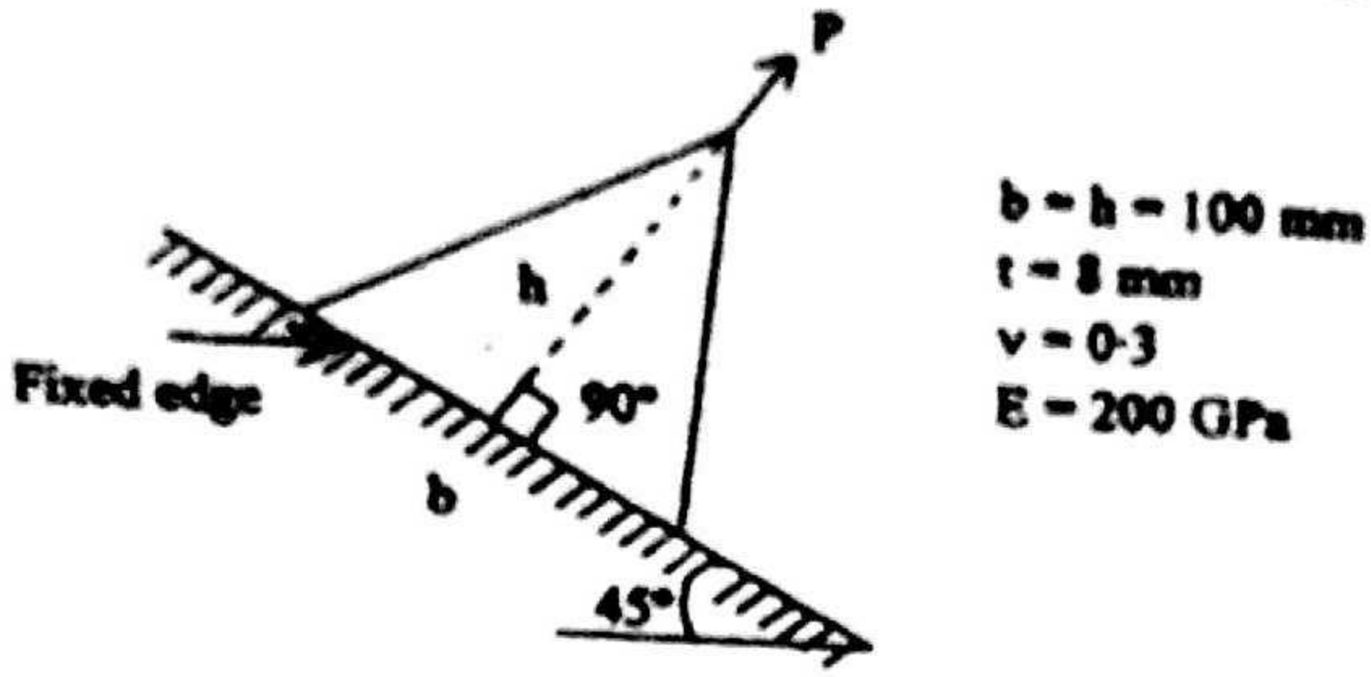
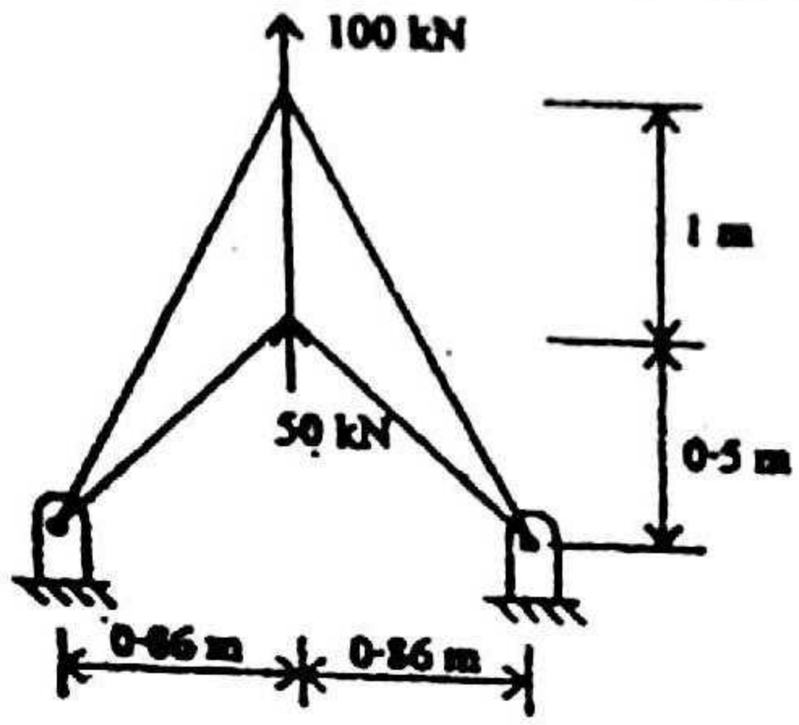


Fig. Q.8

9. Determine with reference to the following Fig.Q.9 :
(i) Global stiffness matrix. (ii) Displacement at Nodal points.
(iii) Reactions at supports. (iv) Stresses in the members. (13)



Assume area of c/s = 200 mm² and
E = 200×10³ N/mm² for all members of truss.
(Not to scale)

Fig. 9

10. (a) Explain the "Simplex Search Method" for multivariable optimization. (7)

(b) Using Bisection method, minimize $F(x) = x^2 + \frac{40}{x}$ in the interval (a, b), a = 1 and b = 4 solve upto 3 iterations. (6)

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Eighth Semester B. E. (Mech) / Sixth Semester B. E. (Mech) (P. T.) Examination

COMPUTER AIDED DESIGN

Time : Three Hours] [Max. Marks : 80

N. B. : (1) Separate answer book must be used for each section.
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(3) Answer **Three** questions from Section A and **Three** questions from Section B.
(4) Assume suitable data wherever necessary.
(5) Illustrate your answers wherever necessary with the help of neat sketches.
(6) Uses of non programmable calculator is permitted.

SECTION A

1. (a) Compare convensional design cycle and CAD. Why CAD is beneficial ? Discuss in detail. 7

(b) Explain working of raster refresh graphics display. Why is frame buffer used ? 6

2. (a) Derive 2D transformation matrix for rotation through θ in ccw. 4

(b) Compare DDA and Bresenham's line generation algorithms. 3

(c) Using Bresenham's line algorithm, find the pixel position along the line paths between end points (10, 5) and (15, 9). 6

3. (a) A triangle formed by A(5, 1), B(6, 3) and C(7, 1) is to be reflected about a line y=3. Find transformation matrix. Find transformed locations of A, B and C.

Plot the line, the original triangle and the transformed triangle on a graph paper. 10

(b) Write the transformation matrices for each of the following :—

(i) Y–shear

(ii) X–shear

(iii) Reflection about X

(iv) Reflection about Y 4

4. (a) What are analytical and synthetic curves ? Explain with suitable example. 4

(b) What are the features of Bezier curve ? 3

(c) Draw Bezier curve with following control points (1, 2) (3, 4) (6, –6) and (10, 8). Take a step size of 0.2 for x(t) and y(t). 6

5. (a) Differentiate between wireframe and surface modeling. 6

(b) Explain solid modeling techniques :—

(i) CSG technique and.

(ii) Boundry representation technique (B–rep) 7

SECTION B

6. (a) Plot and explain the quadratic shape functions for bar element. 7

(b) Discuss properties of stiffness matrix. 4

(c) What do you understand by isoparametric formulation ? 2

7. Consider the structure shown in fig. Q.7

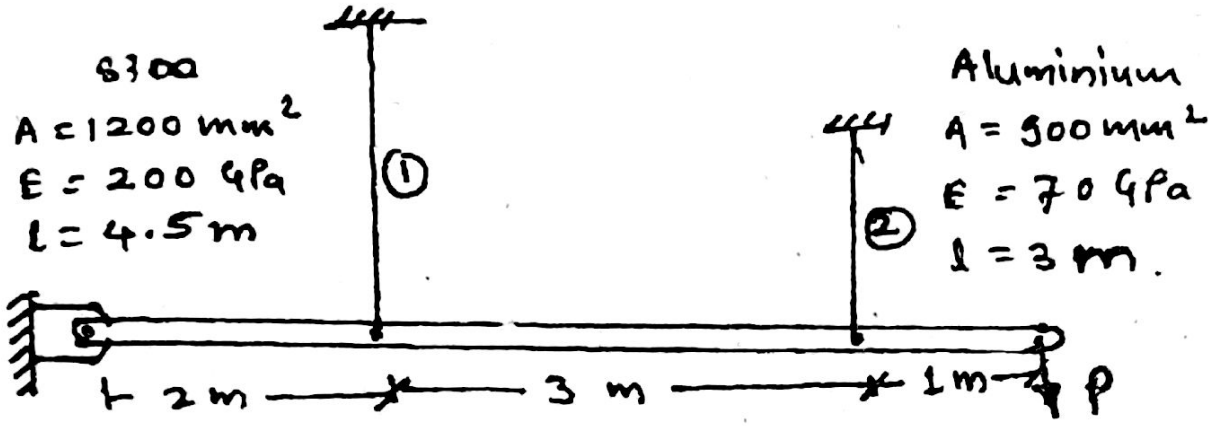


fig. Q. 7

A rigid bar of neglesible mass, pinned at one end is supported by steel rod and aluminium rod. A load P = 30 kN is applied as shown. Model the structure using two finite elements. What are the boundary conditions ? Find Global Stiffness Matrix, solve for displacements and hence find elemental stresses. 14

8. The members of the truss shown in fig. Q. 8

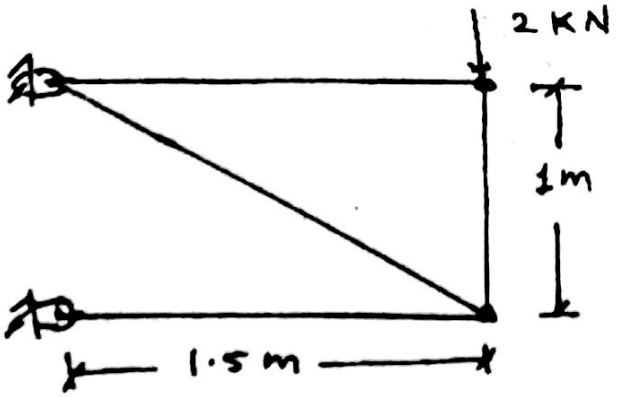
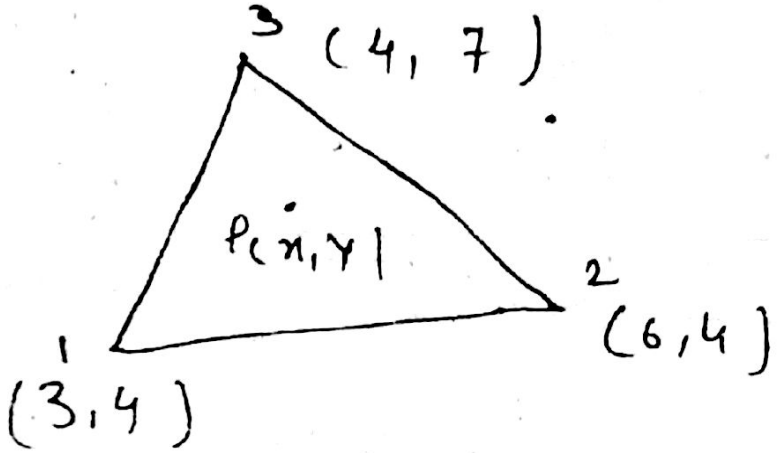


Fig. Q. 8

have c/s area of 15 cm^2 and are made of aluminium alloy with E = 70 Gpa. Determine deflection of each joint. 13

9. (a) Derive the coordinates at point p. if the shape functions are $N_1 = 0.25$, $N_2 = 0.3$ and $N_3 = 0.45$



Find displacement (u, v) at point P if
$q^T = [0.1 \ 0.2 \ 0.15 \ 0.1 \ 0.1 \ 0.2]$ 5

(b) Write an algorithm for Golden Search Method. 8

10. Write short notes on (any **three**) :—

(a) Simplex method

(b) Bisection method

(c) Penalty function method

(d) Comparison of analytical, FEM and experimental methods. 13

B.E. VIII SEMESTER (New Course)

WINTER 2013

COMPUTER AIDED DESIGN

SECTION - A

1. (a) State various CAD softwares available in the market. Explain how CAD softwares help for Education and Training applications. (4)

   (b) Explain conventional design process. Also explain how this process is modified when we use CAD process. (5)

   (c) A raster display of 800 x 1024 resolution has 60 Hz frequency. Find time required to scan each pixel and a horizontal line. (4)

2. (a) Write an algorithm to generate line using Bresenham's principle. (7)

   (b) Write shear transformation of rectangle ABCD show in Fig. 2(a) in x-direction by 2 units and y-direction also by 2 units. (6)

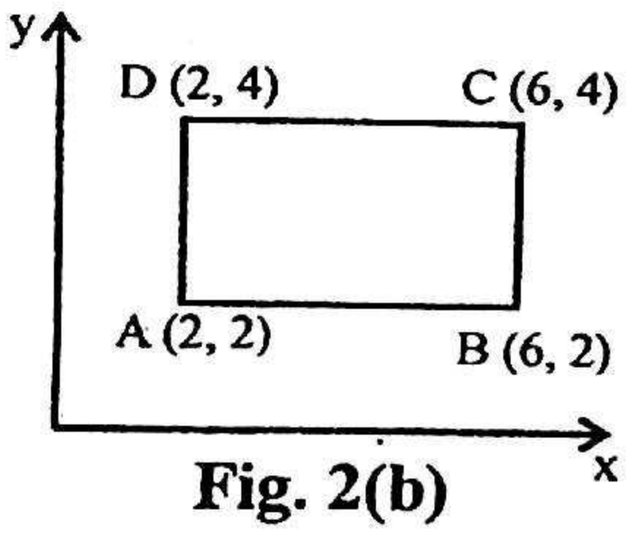


Fig. 2(b)

3. (a) A triangle is defined is 2-D system by its vertices (0, 2), (0, 3) and (1, 2). perform the following transformations on the triangle independently.

   (i) Translate the triangle by 2 units in x-direction and 5 units in y-direction.

   (ii) Scale the triangle (original) by a factor of 1.5.

   (iii) Scale the original triangle by a factor of 1.5 in x-direction and 3 in y-direction.

   (iv) Rotate the original triangle by 45° about the origin in clockwise direction. (8)

(b) Write series of transformation for rotation of point in 3-D space about any arbitrary line.

4. (a) A triangle having vertices (2, 4), (2, 6) and (4, 6) is reflected about the line having equation $Y = \frac{3}{4}(x+4)$. Find the final position of triangle using matrix method. (5)

(b) What is Bezier curve ? State its properties. The co-ordinates of four control points relative to a current WCS are given by : $P_0 = [2, 2, 0]^T$, $P_1 = [2, 3, 0]^T$, $P_2 = [3, 3, 0]^T$ and $P_3 = [3, 2, 0]^T$. Find the equation of resulting Bezier curve. Also find points on the curve for determining 5 points for Bezier curve. Assume u = 0, 0.2, 0.5, 0.8 and 1. (9)

5. (a) Differentiate between CSG and B-rep technique in solid models. (4)

(b) Explain surface of revolution. (4)

(c) Differentiate surface modelling and wireframe modelling. (5)

SECTION - B

6. (a) Fig. 6 shown blockes supporting rigid plate loaded with 200 kN. Determine the stresses induced in each element and reactions at support. The material properties are : (13)

Material	Area mm^2	Elasticity N/mm^2
Steel (St)	200	2×10^5
Aluminium (Al)	370	7×10^4
Beass (Br)	370	8.8×10^4

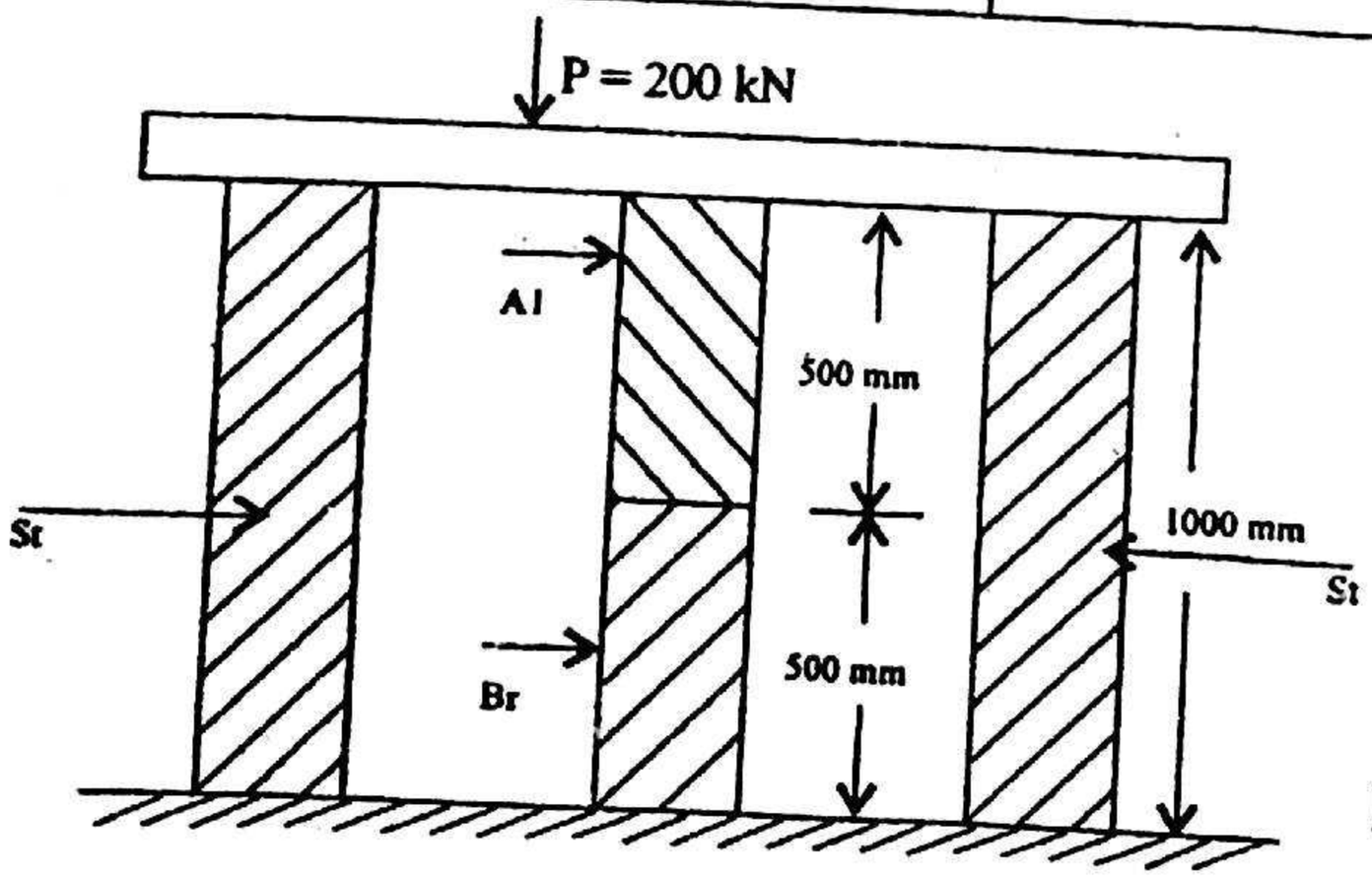


Fig. 6

W-13

7. **Fig.** 7 shows truss, subjected to a load of 15 kN. Determine :
   (a) Displacement at each node.
   (b) Stresses induced in each member.
   (c) Reactions at support.
   Assume all the members having same cross sections.
   Take A = 200 mm², E = 200 GPa. **(14)**

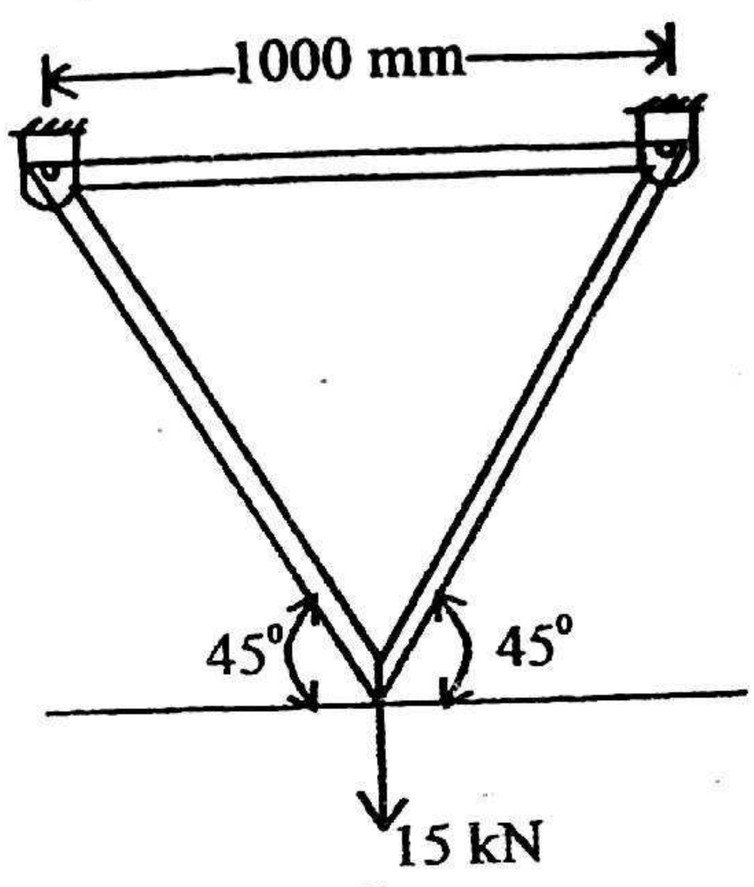


Fig. 7

8. **(a)** For point P located inside the triangle as shown in **Fig. 8(a)**. The Shape Function N_1, N_2 are).15 and 0.25 respectively. Determine x and y co-ordinate of P. **(5)**

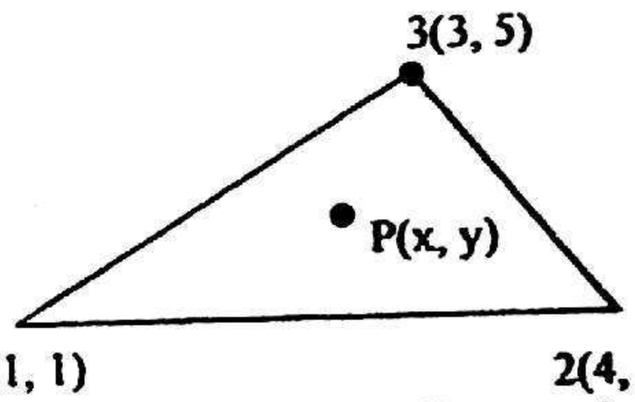


Fig. 8 (a)

   (b) Develop element matrix in 1-dimensional element due to rise in temperature. **(8)**

9. A flat plate is fixed to the rigid free end. Model the plate with two-dimensional plane stresses elements and develop Global stiffness matrix. **(Ref. Fig. 9)**
   Take E = modulus of Elasticity = 200 GPa
   U = Poisson's Ratio = 0.3. **(13)**

Do not like in exam

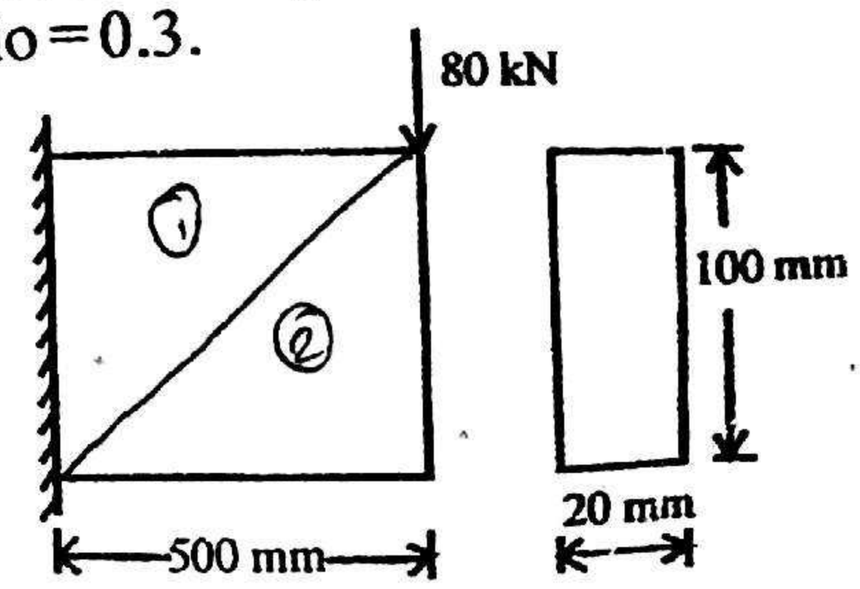


Fig. 9

10. (a) Use four iterations of the golden section search method in order to maximized the function :
$f(x) = 10 + x^3 - 2x - 2$
exp (x) in the interval (-5, 5). (8)

(b) Explain with suitable example, Bisection method of optimization. (5)

• • •

Faculty of Engineering & Technology
Eighth Semester B.E. (Mech.)/
Sixth Semester B.E.P.T. (Mech.) Examination
COMPUTER AIDED DESIGN
Sections—A & B

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Answer **THREE** questions from Section A and **THREE** questions from Section B.

(3) Due credit will be given to neatness and adequate dimensions.

(4) Assume suitable data wherever necessary.

(5) Use of non programmable calculator is permitted.

SECTION—A

1. (a) Explain the software system in CAD. 7

(b) Explain the working of raster scan graphic terminal in detail. What is the role of Frame Buffers in it ? 6

2. (a) Consider two raster systems with resolutions of 800 × 600 and 1280 by 1024. How many pixels could be accessed per second in each of these systems by display controller that has the refresh rate of 60 hz ? What is the access time per pixel in each case ? Also find time to scan a line. 5

(b) Find the pixel positions that would be grown to plot a line $y = 3x + 5$ between (0, 5) and (3, 14). Plot the pixel on graph paper. 8

3. (a) A triangle shown in fig. Q. 3a is to be reflected about the line $y = -x + 10$. Find the transformation matrix and the new vertices of triangle. 8

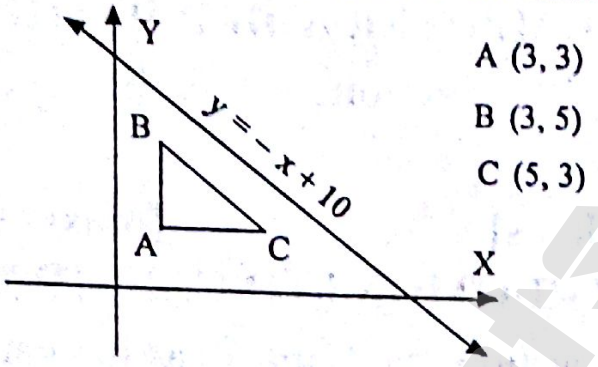


Fig. Q. 3a

(b) A circle of radius 5 cm with centre at A(5, 8) is to be converted into ellipse with major axis $r_1 = 8$ cm and minor axis $r_2 = 5$ cm. Find the transformation matrix. 6

4. (a) What are Homogeneous Co-ordinates ? Justify their need. 4

(b) A cone with its base in X, Y plane and centre of base circle at (0, 0) has radius of 5 and axis along z axis of height 10 is rotated about a line A passing through L(0, 0, 0), A (20, 10, 10) by 45° clockwise. What are the co-ordinates of vertex of cone before and after transformation ? Explain step by step concatenation of all transformation matrixes. 9

5. (a) What are Analytical and Synthetic Curves ? Explain. 4

(b) What are features of Bezier Curve ? 4

(c) Compare different Solid Modelling Techniques. 5

SECTION—B

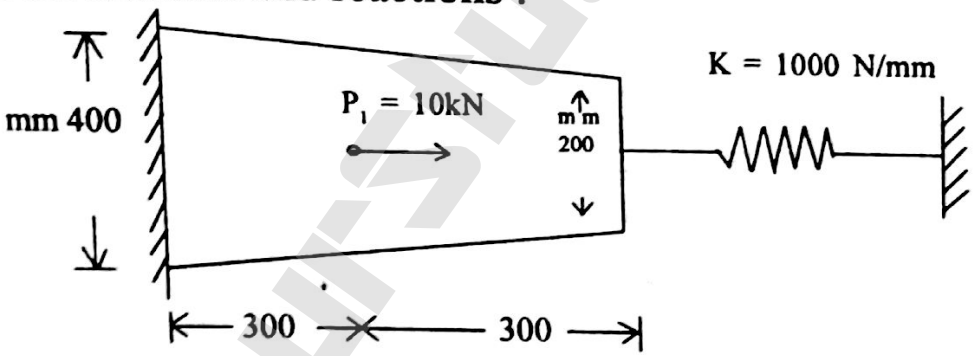
6. (a) What is the significance of shape functions ? Write and plot shape functions for quadratic shape function. 5

(b) Derive the strain-displacement matrix B for linear bar element having the shape functions :

$$N_1 = \frac{1-r_1}{2} \text{ and } N_2 = \frac{1+r_1}{2}$$

Also explain the meaning of isoparametric elements. 8

7. For the component shown in fig. (7), treating as one dimensional element, determine nodal displacement, stresses in all element and reactions : 13



Est. = 200 Gpa

8. For the truss shown in figure Q. 8 :

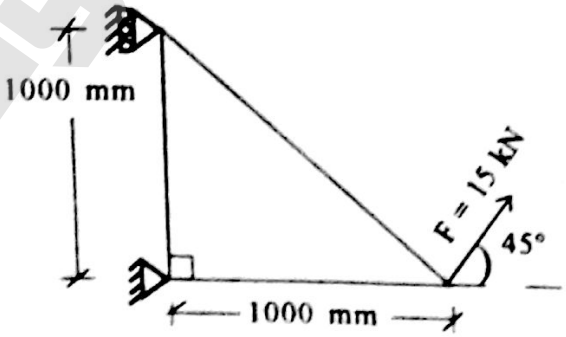


Fig. Q. 8

Find deflection of each node, stress in each of the elements and reactions at support. Area of c/s for each bar is 200 mm^2. Take E = 200 Gpa. 13

9. For the two dimensional element shown in fig.Q.9, assemble Global Stiffness Matrix :

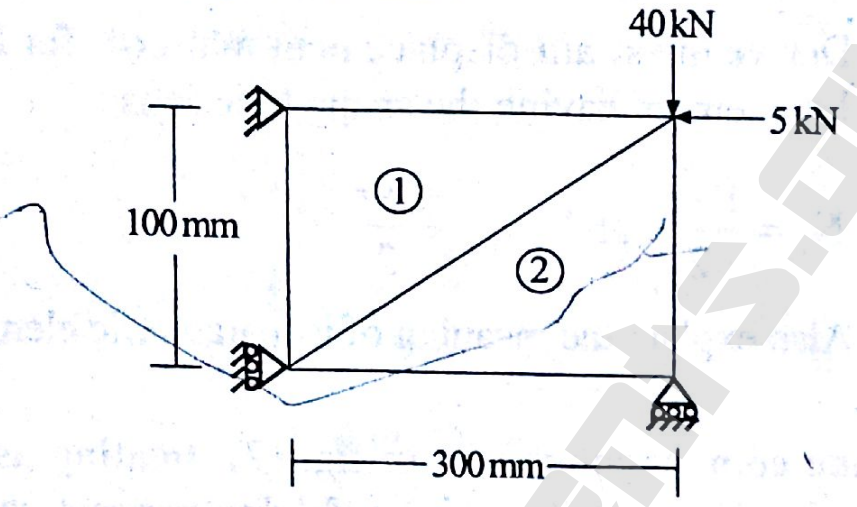


Fig. Q. 9

Take E = 200 Gpa, thickness of plate = 20 mm and Poisson's ratio $\nu = 0.3$. 13

10. Write short notes on (any **THREE**) :
    (a) Bisection Method
    (b) Simplex Method
    (c) Advantages of CAD
    (d) Properties of Stiffness Matrix. 14

Faculty of Engineering & Technology

Eighth Semester B.E. (Mechanical)/Sixth Semester B.E.P.T. (Mechanical) Examination

COMPUTER AIDED DESIGN

Sections—A & B

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Answer **THREE** questions from Section A and **THREE** questions from Section B.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

(5) Use of Logarithmic tables and non-programmable calculator is permitted.

(6) Use of Design data book by B.D. Shiwalkor is permitted.

SECTION—A

1. (a) Explain Raster Scan display technique with neat sketch. 5

(b) Explain Product design cycle. Also explain all design stages in CAD. 8

2. (a) Write midpoint ellipse scan conversion algorithm. Generate an ellipse having a = 5 and b = 3 units, in first quadrant only. 9

(b) Apply the shearing transformation to square with A[0, 0]; B[1, 0]; C[1, 1] and D[0, 1] as given below :

(i) Shear parameter value of 0.5 relative to x axis.

(ii) Shear parameter value of 0.5 relative to y axis. 4

3. (a) Explain in brief reflection transformation for the following situations along with transformation matrix and related original image and reflected image :

(i) Reflection about Y axis

(ii) Reflection about X axis

(iii) Reflection about origin

(iv) Reflection about line y = x

(v) Reflection about line y = –x. 8

(b) Find the transformation matrix that transforms the given square ABCD to half its size with centre remaining still at the same position. The co-ordinate of the square are A[1, 1]; B[3, 1]; C[3, 3]; D[1, 3] and centre at [2, 2]. Also find the resultant co-ordinates of the square. 5

4. (a) What do you understand by surface of revolution ? Explain the generation of conical surface. 5

(b) Explain C.S.G. modelling with suitable example. 4

(c) Explain Bezier Curve. Enlist various properties of Bezier curve and its application. 5

5. A triangle is defined by 3 vertices : A[0, 2, 1]; B[2, 3, 0]; C[1, 2, 1]. Find the final co-ordinates after it is rotated by 45° about a line joining the points [2, 2, 2] and [1, 1, 1] in CCW direction. 13

SECTION—B

6. (a) Explain in brief the principle of minimum potential energy. 5

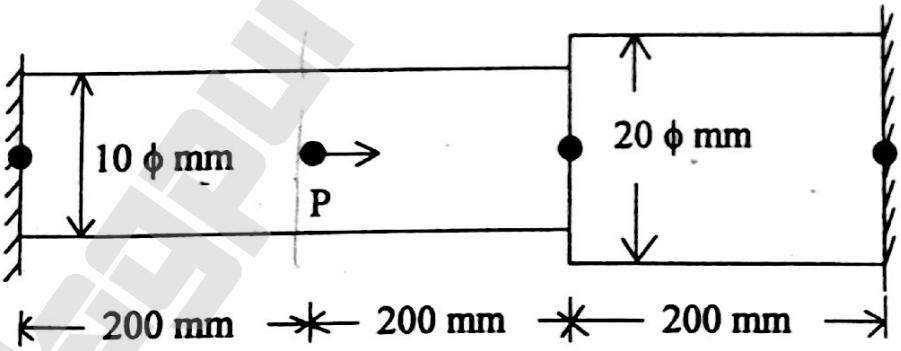
(b) For the three bar assemblage shown in Fig. 6(b) determine :

(i) The global stiffness matrix :

(ii) The nodal displacement

(iii) Stresses in all elements

(iv) Reactions. 9



P = 2 kN

E = 200 GPa

Fig. 6(b)

7. For the plane truss shown in Fig. (7), determine the horizontal and vertical displacement of node (1) and the stresses in all elements. The cross-sectional area of all elements is 400 mm^2 and elastic constant E = 200 GPa. 13

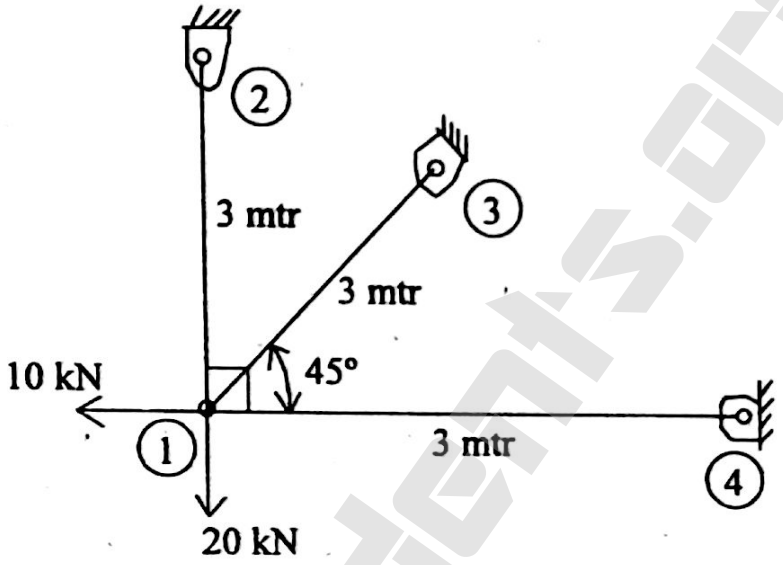


Fig. 7

8. For a CST element shown in Fig. (8) if the nodal displacement vector is :

$\phi^T = [0, 0, 0.3, 0.5, 0.2, -0.1]$, find the element stress. 13

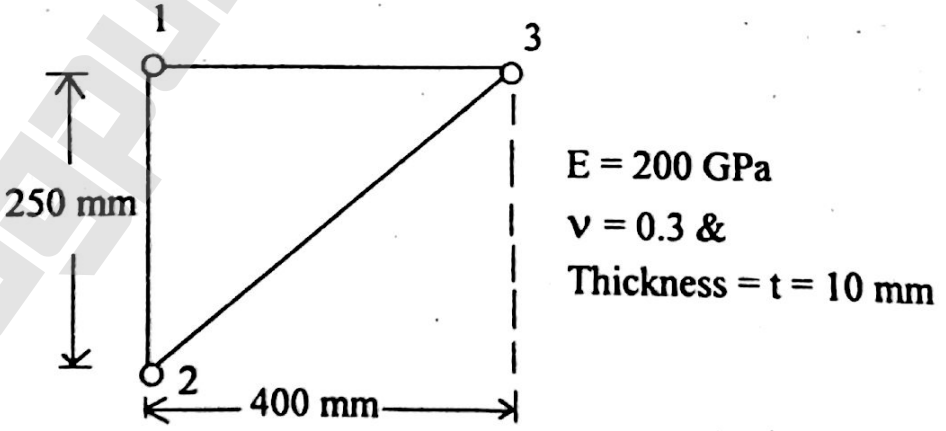
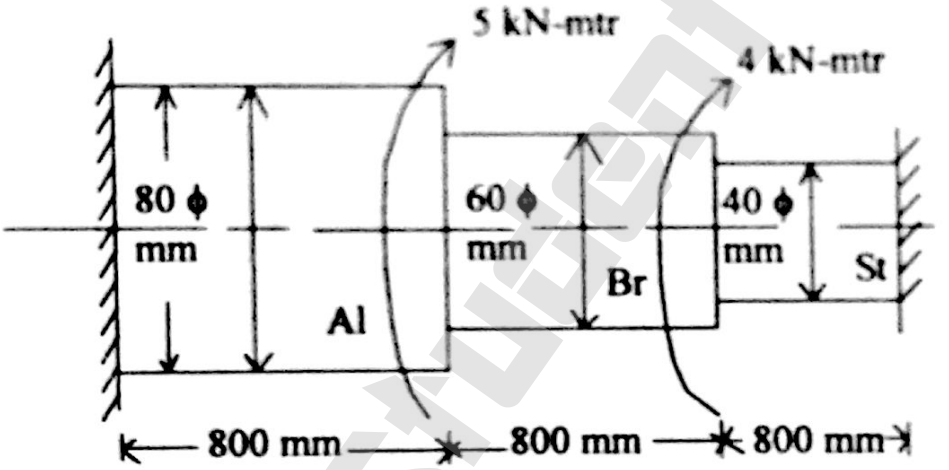


Fig. 8

9. (a) What do you mean by multivariable optimization ? And how is it classified ? Explain any one. 6

(b) Explain Golden Section Search method with an example of single variable optimization algorithm. 7

10. Determine the angle of twist in degrees at the steps, the maximum shear stress in each section and the reactions at the walls for the stepped circular bar as shown in Fig. (10). 13



$G_{Al} = 27$ GPa

$G_{Brass} = 49$ GPa

$G_{st} = 77$ GPa

Fig. 10

Faculty of Engineering & Technology

Eighth Semester B.E. (Mech. Engg.)/Sixth Semester B.E.P.T. (Mech.) Examination

COMPUTER AIDED DESIGN

Sections—A & B

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Answer **THREE** questions from Section A and **THREE** questions from Section B.

(3) Due credit will be given to neatness and adequate dimensions.

(4) Assume suitable data wherever necessary.

(5) Illustrate your answers wherever necessary with the help of neat sketches.

(6) Use of non-programmable calculator is permitted.

SECTION—A

1. (a) Explain software modules with respect to any Commercial package. 6

   (b) Differentiate between Raster scan and Random scan display system. 5

   (c) Explain Frame buffer. 2

2. (a) Write an algorithm to generate circle using Bresenham's principle. Explain with suitable example and show it on graph paper. 7

(b) A square having end points A(1, 1), B(6, 1), C(6, 6) and D(1, 6) is rotated by 50° in clockwise direction keeping point (6, 1) fixed. Write total transformation matrix. 6

3. (a) A sphere having centre (10, 10, 10) and radius 8 units is translated by 3 units in X direction and 5 units in Z direction. Then it is rotated by 45° in anticlockwise direction about Y axis. Find new centre of sphere. 9

(b) Explain 2D shear transformation. 4

4. (a) What are analytical and synthetic curves ? Explain with suitable examples. 4

(b) What are features of Bezier curve ? 3

(c) A triangle having vertices (3, 5), (3, 7) and (4, 6) is reflected about a line having equation $Y = 0.5X + 3$. Find new position of triangle. 7

5. (a) Explain solid modeling techniques. 6

(b) Differentiate between Constructive solid Geometry and Boundary representation technique. 7

SECTION—B

6. (a) Explain the principle of Minimum potential energy. 3

(b) What do you understand by pre-processing and post-processing in Finite element analysis. 5

(c) A one dimensional linear element is subjected to uniform body force 'f' per unit volume. Derive an expression for nodal body force vector for the element. 5

7. For axially loaded member shown in Fig. 7. Determine (1) Nodal displacement, (2) Stress in each element and (3) Reaction at fixed support.

Given : E = 200 GPa, P = 10 kN

Plate thickness = 10 mm

[Neglecting self weight] 13

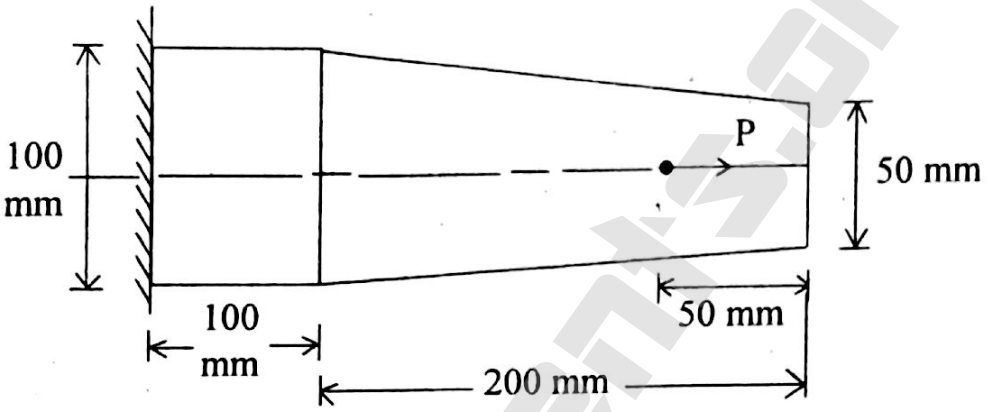


Fig. 7

8. A truss shown in Fig. 8 with cross-section area of all elements equal to 300 mm^2 and Youngs modulus $E = 2 \times 10^5$ MPa. Determine :

(1) Displacement at nodal point

(2) Stresses in each element

(3) Reaction at supports. 13

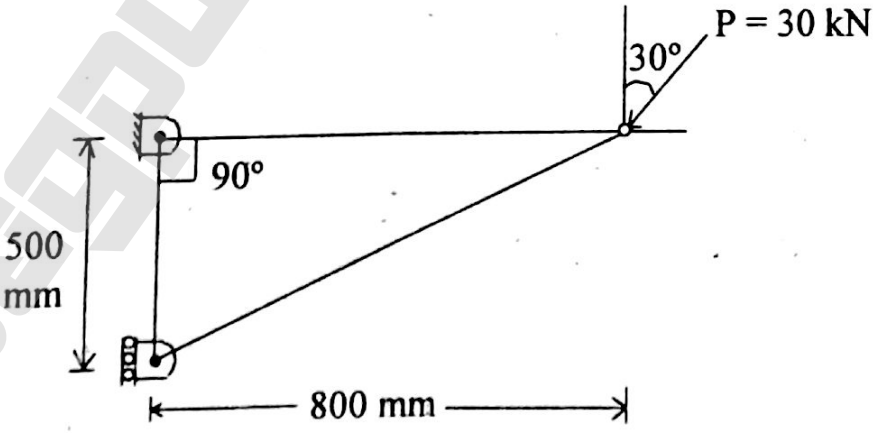


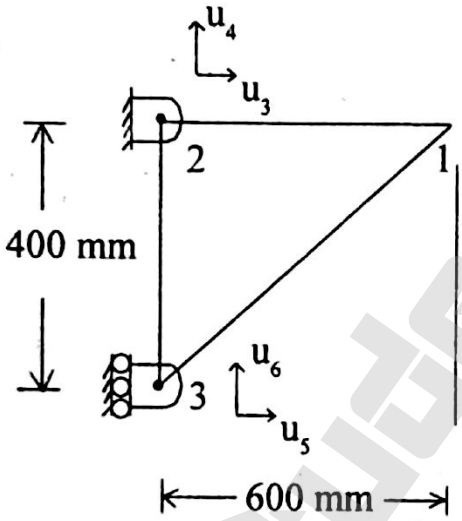
Fig. 8

9. (a) What is plane stress and plain strain condition ? State examples along with the importance of these conditions with respect to FEM. 5

(b) For the plain strain element shown in Fig. 9(b). The nodal displacements, properties of element and geometrical parameters are shown in Fig. 9(b). Use unit thickness of Plate. Determine :

(i) Strain displacement matrix

(ii) Stresses induced in the element. 9



u_1 = 0.005 mm E = 200 GPa

u_2 = 0.002 mm γ = 0.3

u_3 = 0.00 mm t = 1 mm

u_4 = 0.00 mm

u_5 = 0.00 mm

u_6 = 0.004 mm

Fig. 9(b)

10. (a) Explain Golden Search method for single variable optimization problem. 6

(b) Explain Simplex search method for multivariable optimization 7

NTK/KW/15/7561

Faculty of Engineering & Technology

Seventh Semester B.E. (Mech. Engg.) (C.B.S.) Examination

COMPUTER AIDED DESIGN

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Solve Question No. **1 OR** Question No. **2**.

(3) Solve Question No. **3 OR** Question No. **4**.

(4) Solve Question No. **5 OR** Question No. **6**.

(5) Solve Question No. **7 OR** Question No. **8**.

(6) Solve Question No. **9 OR** Question No. **10**.

(7) Solve Question No. **11 OR** Question No. **12**.

(8) Assume suitable data wherever necessary.

(9) Use of non programmable calculator is permitted.

(10) Use of design data book is permitted.

10. A two dimensional plate of thickness 20 mm is shown in fig(10). Determine the nodal displacement. Take

E = 200 GPa and ν = 0.3. 14

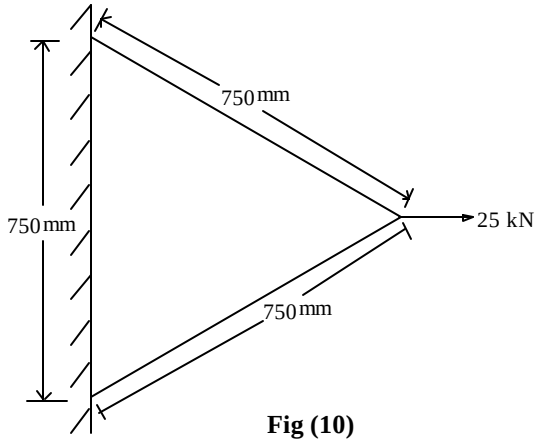


Fig (10)

11. (a) Explain in brief the basic steps in method of optimum design. 5

(b) A simply supported beam of length 1000 mm is subjected to concentrated load of 9kN at midpoint of beam. Optimise (Design) the beam for minimum deflection and take factor of safety = 1.5. The available materials are SAE 1030; SAE 2345 and Ph. Bronze. 9

OR

4. (a) A square having vertices (1, 4); (1, 1) (4, 1) and (4, 4) is reflected about the line having equation y = 3x + 4. Find the final position of the square. 8

(b) Explain in brief various types of 3-D transformations with their matrix representations. 5

5. (a) Enlist the properties of bezier curve. The coordinates of four control points of curve is given by B_0[1.5, 2], B_1[3, 3]; B_2[6, 3]; B_3[8, 2]. Find the equation of resulting Bezier curve. Also find the coordinates of point lying on curve at t = 0, 0.25, 0.5, 0.75, 1. 9

(b) Define and describe with example any two solid modeling entities or primitives. 4

OR

6. (a) Explain in brief assembly modeling. 5

(b) What do you understand by mating relationship or constraints. Explain in brief various types of mating relations in 2D and 3D used in Assembly Modeling. 8

7. (a) Explain in brief Basic steps of Finite Element Method. 5

(b) Determine the angle of twist at the step and the maximum shear stress in each section for the stepped circular bar shown in fig 7(b). take G = 77 GPa. 8

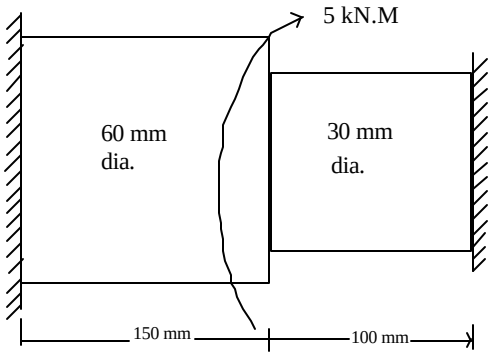


Fig 7(b)

OR

8. A composite shaft is subjected to load as shown in fig (8). Determine displacements and stresses in each section.

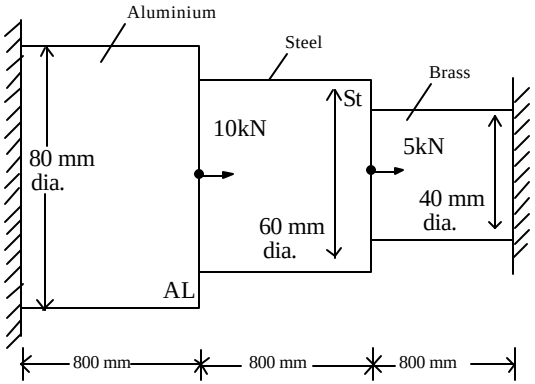


Fig 8

E_{st} = 200 GPa

E_{AL} = 70 GPa

E_{Br} = 105 GPa. 13

9. A truss is shown in fig (9). The cross section area of all elements is 450 mm^2 and E = 2×10^5 N/mm^2.

(i) Determine the element stiffness matrix for each element.

(ii) Assemble the structural stiffness matrix for entire truss

(iii) Find the nodal displacement.

(iv) Find the stresses in all elements

(v) Calculate the reaction force. 14

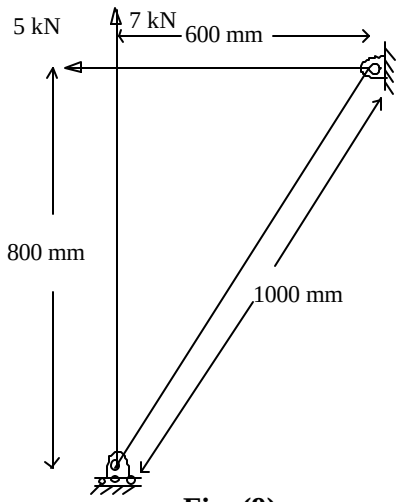


Fig (9)

OR

1. (a) What is a Bit Plane ? How bit planes are used to get different colors. 8

(b) What is conventional design process ? How this process is modified when we use cad process ? 5

OR

2. (a) Write the Bresenham's circle drawing algorithm in first quadrant. Using the algorithm generate the circle in first quadrant with radius equal to 5 on graph paper. 9

(b) Explain in brief how circle can be generated by parametric equation. 4

3. (a) A triangle with vertices (3, 6); (7, 6); and (5, 11) is first scaled by 1.5 units about fixed point (4, 7) then translated by 2.5 units in x and y direction respectively and finaly rotated about point (2, 2) in counter clockwise direction by 45^0. Find final position of triangle. 10

(b) Explain in brief windowing and clipping. 3

OR

12. Design a circular shaft for minimum torsional deflection, for the following conditions :

(i) Length should be between 600 to 900 mm.

(ii) Diameter should be between 10 mm and 75 mm.

(iii) Factor of safety = 1.5

(iv) Twisting moments = 85 kN. meter

(v) Available materials :

SAE 1030; SAE 1050; SAE 3140 and Al. Alloy-260. Sketch the variational diagram. 14

B.E. (Mechanical Engineering) Seventh Semester (C.B.S.)

Computer Aided Design

P. Pages : 3 **TKN/KS/16/7561**

Time : Three Hours * 0 9 0 6 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.
11. Use of Design data book is permitted.

1. a) Write Bresenham's line drawing algorithm for generation of line. **7**

b) Compare convensional design and CAD. Why CAD is beneficial? Discuss in details. **6**

OR

2. a) Explain working of raster refresh graphics display. Why frame buffer used? **6**

b) Write and explain Bresenham's ellipse drawing algorithm for the generation of ellipse. **7**

3. a) Find out the final position of line having end points (2, 2) and (10, 4). When it is translated by 5 units in Y – direction. Then scaled 2 units in X – direction and then rotated by 45º in clockwise direction about fixed point (2, 2). **7**

b) Show that the reflection of point about line Y = X is same as scaling followed by rotation about origin. **7**

OR

4. a) Determine the transformation matrix to take reflection of a point about line Y = 2x – 5. **7**

b) A cube of length 12 units is having one of its corner at the origin (0,0,0) and three edge along the three principal axes. If the cube is to be rotated about Z-axis by an angle 30º in the clockwise direction, calculate the new position of the cube. **7**

5. a) Determine the five points on the Bezier curve if $B_0[1, 1]$, $B_1[2, 3]$, $B_2[4, 3]$, $B_3[3, 1]$ the vertices of a Bezier polygon at $t = [0, 0.2, 0.4, 0.6, 0.8]$. **7**

b) Explain wire frame modeling along with its advantages and disadvantages. **6**

OR

6. a) Explain Bezier curve and write its basic properties. **6**

b) Explain the following : **7**

i) Importance of precedence diagram.

ii) Geometric modeling.

7. In fig. 1 a load of $P = 60 \times 10^3 N$ is applied as shown. Determine the displacement, stresses and support reaction in the body. Take $E \neq 20 \times 10^3 N/mm^2$. **13**

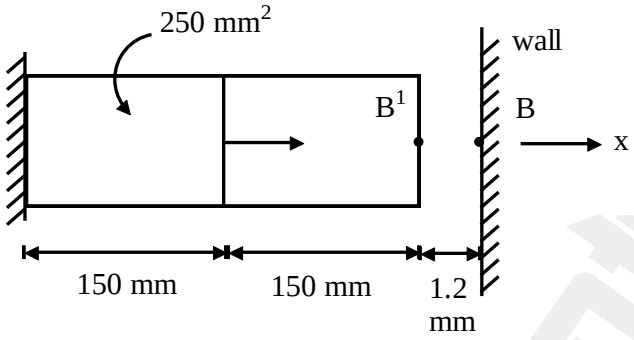


Fig. 1

OR

8. Determine the Nodal displacement at node 2, stresses in each element and support reactions in the bar shown in fig. (2), due to applied force $P = 500 \times 10^3 N$ and temperature rise of 75ºC. **13**

Given :

$A_{AE} = 2400\,mm^2$ $\quad A_{st} = 1300\,mm^2$

$L_{AL} = 250\,mm$ $\quad L_{st} = 300\,mm$

$E_{AL} = 0.7 \times 10^5\ N/mm^2$ $\quad E_{st} = 2 \times 10^5\ N/mm^2$

$\alpha_{AL} = 22 \times 10^{-6}$ per °C $\quad \alpha_{st} = 12 \times 10^{-6}$ per °C

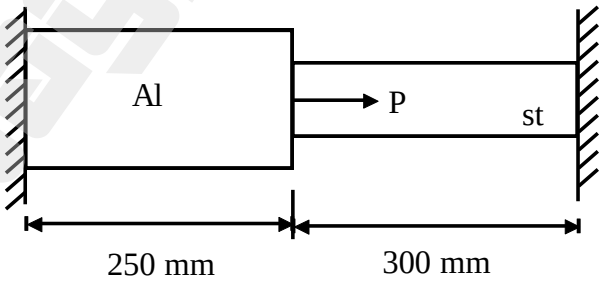


Fig. 2

9. A truss shown in fig. (3) with cross sectional area of all element is $400\,mm^2$ and $E = 200\times10^3\,N/mm^2$. Determine the displacement stresses and support reaction. **14**

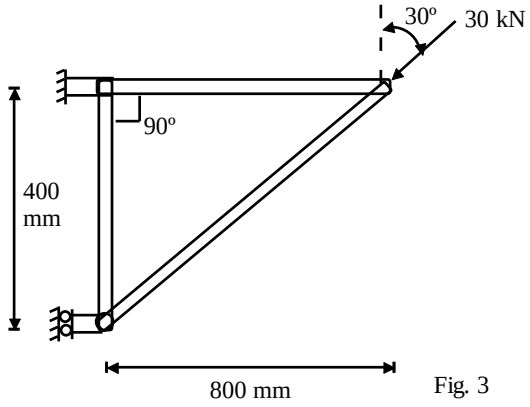


Fig. 3

OR

10 A two dimensional plate is loaded by a 20 KN force as shown in fig. (4). The thickness of plate is 12 mm and elastic modulus $E = 2\times10^5\,N/mm^2$ and Poisson ratio $\mu = 0.25$. Determine nodal displacement using plane stress condition. **14**

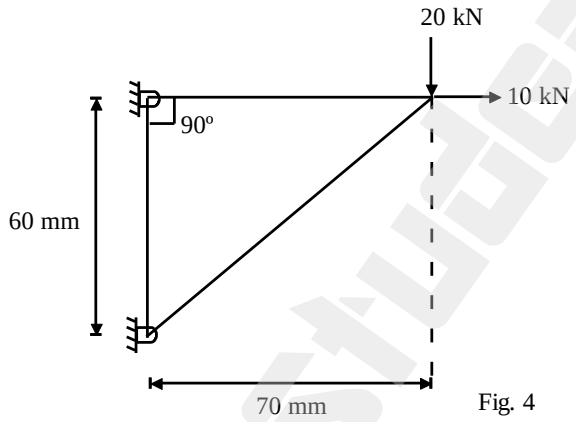


Fig. 4

11 a) A circular rod subjected with twisting moment 75 N-m. The length of shaft is 700 mm and factor of safety is 1.6. Design the shaft for minimum angle of twist, for the following material. **9**

i) SAE 1045 (oil quenched and drawn at 700ºC)
ii) SAE 3220
iii) SAE 2340 (Annealed)
iv) SAE 3120 (oil quenched)
v) Yellow Brass

b) Describe in detail the Adequate design and optimum design. **4**

OR

12. A tensile bar is subjected to the following conditions. Tensile load, F = 90 KN, Factor of safety = 1.6. length of bar = 500 mm. **13**
The diameter, 10 mm ≤ d ≤ 50 mm
Design the bar for minimum weight for the following material.

i) SAE 1010
ii) SAE 1095
iii) Alluminium 260
iv) Yellow Brass
v) Phosphore Bronze

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B.E. (Mechanical Engineering) Semester Seventh (C.B.S.)

Computer Aided Design

P. Pages : 3 **KNT/KW/16/7474**

Time : Three Hours * 0 8 6 9 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data wherever necessary.
10. Illustrate your answers wherever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use of Design databook is permitted.

1. a) Explain the phases of computer aided design process. **6**

b) Differentiate between Raster scan and Random scan display systems. **7**

OR

2. a) Explain in brief how an ellipse can be generated using parametric equation. **6**

b) Draw the line between end points (10,5) and (15,9) by using Bresenham's line algorithm. **7**

3. a) What do you understand by special transformations? Explain its utility. **5**

b) Triangle ABC vertices A(1,1) B (1,7) C(5,4) is scaled by three units in X – direction and rotated by 30º in the anticlockwise direction keeping point (1,1) fixed. Find the transformation matrix and final position of triangle ABC. **9**

OR

4. a) A triangle having vertices (3,2), (3,6) and (8,4) is reflected about the line having equation y = 3x+4. Find the final position of triangle using 2D transformation. **8**

b) A cube of 10 units is having one of its corner at the origin (0,0,0) and three edges along three principle axes. If the cube is to be rotated about Z-axis by an angle 45º in counter clockwise direction. Calculate the New position of the cube. **6**

5. a) Explain the concept of following modeling technique in brief. **6**
i) Wireframe modeling.
ii) Surface modeling
iii) Solid modeling.

b) State the importance of mating condition in assembly modelling. Enlist various types of mating constraints considered in 2-D and 3-D Assembly modelling. **7**

OR

6. a) Explain the characteristics of B-spline curve. **4**

b) Given $P_0(1,1)$, $P_1(2,3)$, $P_2(4,3)$, $P_3(3,1)$ are the vertices of the Bezier polygon. Determine five points on Bezier curve at t = 0, 0.2, 0.4, 0.6, 0.8, 1. **9**

7. a) Discuss in detail the various steps involved in FEM. **6**

b) Explain in brief the types of element used in FEM. **4**

c) Explain the principle of minimum potential energy. **3**

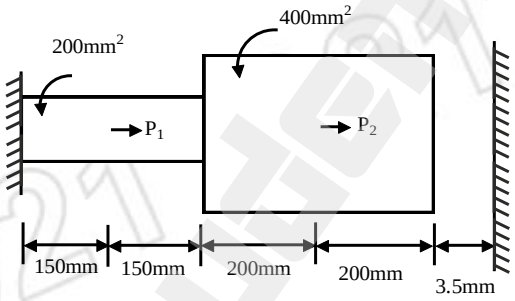
OR

8. For axially loaded member shown in Fig. (8) determine **13**

i) Nodal displacement

ii) Stress in each element

iii) Reaction at fixed end.



Take E = 200 GPa
P_1 = 300 kN
P_2 = 600 kN

Fig. (8)

9. Figure (9) shows three bar truss with pin joints. Given E = 200 Gpa, c/s area of each element = 350 mm^2. Determine (i) Nodal displacement 2) stress in each element 3) Reaction at support. **14**

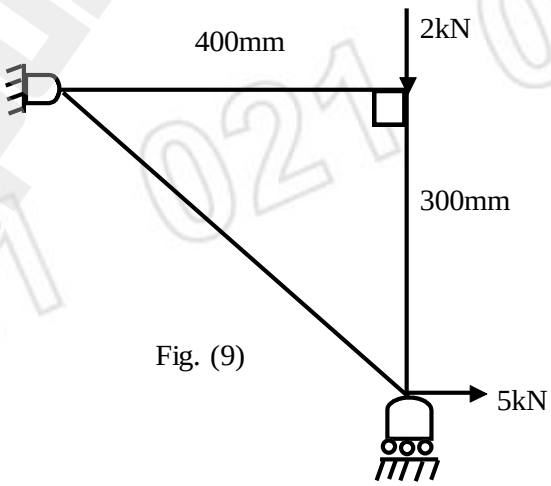


Fig. (9)

OR

10. For triangular plate shown in Fig. (10) determine nodal displacements and element stresses using a one element model **14**
Take E = 70 Gpa, v = 0.25, t = 10 mm. Assume plane stress condition.

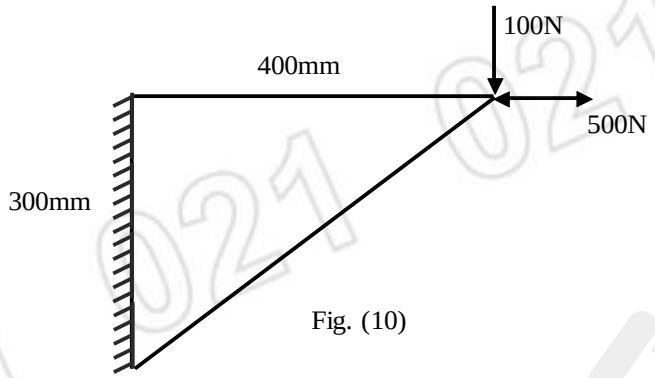


Fig. (10)

11. A shaft is to be used to transmit a torque of 2000 N-m. The required torison stiffness of shaft is 1200 N-m 1degree, while factor of safety based on yield strength in shear is 2. Using maximum shear stress theory design the shaft with the objective of minimizing the weight , out of the following materials. **13**

1) SAE 1030

2) SAE 4140

3) Aluminum 260

4) SAE 1010

OR

12. A simply supported beam having rectangular cross-section and length 950mm is subjected to a load of 8.5 KN acting at the center of the beam. **13**
Design the beam with following specifications;
Factor of safety; N = 1.6 d/b ratio: K = 5
Depth (d) should lie between 15 mm and 150 mm; solve the problem for minimum deflection using following material.

1) SAE 3120 (oil quenched)
2) SAE 1010
3) Aluminum 260

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B.E. Seventh Semester (Mechanical Engineering) (C.B.S.)

Computer Aided Design

P. Pages : 3 **NKT/KS/17/7474**

Time : Three Hours * 0 1 4 3 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use of Design data book is permitted.

1. a) Differentiate between conventional design and CAD design. **4**

b) Write Bresenham's algorithm for line generation for slope less than one [m<1]. Using the algorithm generate line from [5, 8] and [9, 11]. **9**

2. a) Compare raster scan and vector scan displays. **4**

b) Write midpoint algorithm for circle generation in first quadrant/octant. Using the algorithm draw a circle of radius 4 unit in 1^{st} quadrant or octant. **9**

3. a) Find the co-ordinate of figure bounded by (1, 4); (4, 1); (7, 4); (4, 7) when reflected along the line y=2x+8 and sheared by 2 units in x-direction. **7**

b) A rectangle A (4, 4); B (8, 4); C (8, 8); D (4, 8) is scaled by 1.5 units is y-direction about it's center point. Further it is rotated about it's center point by 90º in CCW direction. Find the final position of rectangle. **7**

4. a) Write the 3-Dimensional concatenation matrix for rotation about an arbitrary axis. **7**

b) A tetrahedron is having vertices (6, 6, 0); (14, 6, 0); (10, 13, 0) and (10, 13, 7.75) is scaled by 1.5 unit in x, y and z direction respectively find the final position of tetrahedron. **7**

5. a) Explain with suitable example how CSG model can be created using set theory. **6**

b) Explain in brief the mating relationship or constraints with the help of example explain how mating relations are used in 3D Assembly modeling. **7**

6. a) The co-ordinate of four control points of curve is given by $B_0[3, 4]$; $B_1[6, 6]$; $B_2[12, 6]$; $B_3[15, 3]$. Find the equation of resulting Bezier curve. Also find the co-ordinate of points lying on curve at t = 0, 0.3, 0.5, 0.8, 1. **8**

b) Explain in brief B-spline curve. **5**

7. a) Enlist the various types of elements used in FEM alongwith their characteristics. **4**

b) Fig. 7 (b) shows a taper bar subjected to point load of intensity 10kN at it; free end, along-with self weight. Take **9**

E = 200 GPa; density = $\rho = 86 \times 10^{-6}\ N/mm^3$.

Determine the deflection at free end and stresses and support reaction

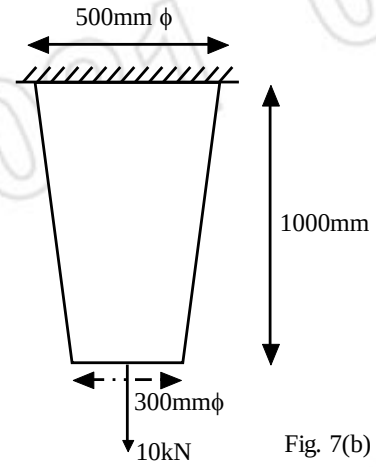
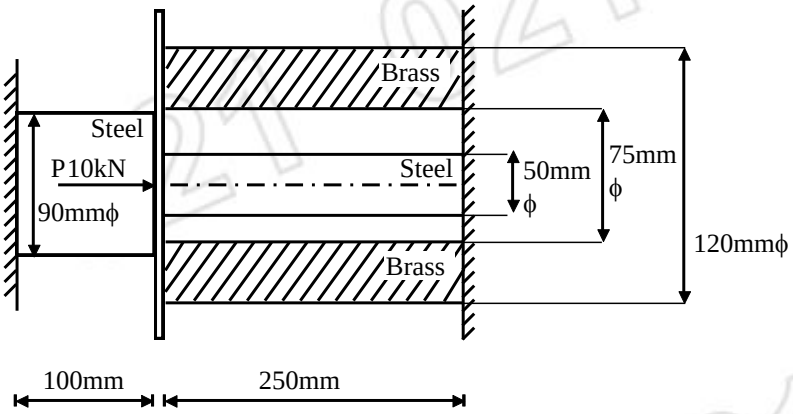


Fig. 7(b)

8. For the composite element shown below in fig (8) calculate the nodal displacement, stresses and reactions. **13**



E Steel = 200 GPa
E Brass = 105 GPa

Fig (8)

9. A tress shown in fig (9). The cross-section area of element is $500mm^2$ and $E = 200GPa$. **13**

Determine the nodal displacements, stresses in all members and reactions at support.

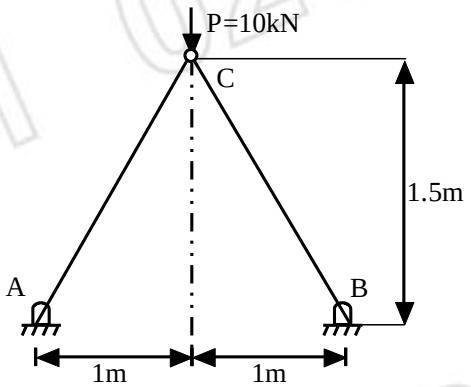


Fig. (9)

10. A two Dimensional triangular plate of thickness 15mm is shown in fig (10). Determine the nodal displacement. **13**

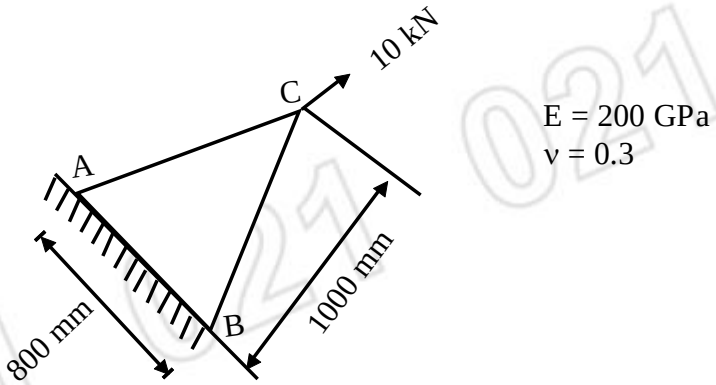


Fig. (10)

11. A simply supported beam of rectangular cross-section having distance between support 900 mm is subjected to load of intensity 1kN at midpoint of beam. Design the beam with following specifications. **14**
Factor of safety = N = 1.6,
depth / breath (d/b) = 2.5,
The depth 'd' should lie in between 15 mm and 150 mm. Solve the problem for minimum deflection for the following material
SAE1030; SAE 1112 cold drawn; SAE4340
Aluminium Alloy 260.

12. a) Explain in brief the various types of Modified optimization Design [MOD] problem. **4**

b) A cantilever beam circular in cross-section is subjected to load of intensity 2kN at it's free end. The length of beam is 1000mm. The factor of safety is 1.5. Design the beam for minimum deflection for the materials AL-Alloy-260; SAE1030 and SAE4340. **10**

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B.E. (Mechanical Engineering) Seventh Semester (C.B.S.)

Computer Aided Design

P. Pages : 3 **NRJ/KW/17/4613**

Time : Three Hours * 0 4 8 7 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
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7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use of design data book is permissible.

1. a) Explain Computer Aided Design, it's applications and advantages over conventional design. **5**

b) Write DDA line generations algorithm and rasterize a line having end coordinates A (2, 5) and B (6, 10). **8**

OR

2. a) What is Raster Scan Display? Explain the use of frame Buffer with a neat diagram. **5**

b) Write Bresenham's mid-point circle generation algorithm and rasterize a circle with Centre at (30, 20) and radius 9 units. **8**

3. a) What are transformations? Explain 2D Normal transformations using suitable derivations (any one). **5**

b) A rectangle having vertices at A (3, 3) B (7, 3) C (3, 7) D (7, 7) is reflected about a line having equation 'Y = 3x – 5', calculate the coordinates of reflected rectangle. **9**

OR

4. a) What is windowing and clipping? **3**

b) A triangle ABC having vertex coordinates. **11**
A (0, 0, 0, 1)
B (7, 2, 5, 1)
C (2, 3, 1, 1)
- is scaled by 2 units in x-direction, 3 units in y-direction and 3 units in z-direction.
- it is then rotated by 30º (C.W) about y-axis.
- finally it is translated by 3 units in all the directions.

Calculate the coordinates of transformed triangle.

5. a) Explain wireframe modeling and surface modelling with proper illustration. **5**

b) What are the properties of a Bezier curve? Rasterize a Bezier curve having control point coordinates P_0 (3, 3, 0) P_1 (3, 4, 0) P_2 (4, 4, 0) P_3 (5, 2, 0) **8**
When U = 0, 0.25, 0.5, 0.75, 1.

OR

6. a) What is Assembly modeling? Explain generation of assembly sequences. **5**

b) Explain the following. **8**

i) Constructive solid Geometry (C.S.G).
ii) Boundary representation techniques.

7. a) Explain principle of minimum potential Energy with suitable derivation. **4**

b) For the step shaft shown in the fig (1) having following properties. **10**
Modulus of Elasticity 210 GPa.

SECTION	L (mm)	D (mm)
A	400	50
B	300	35

Calculate :

i) Nodal Displacement.
ii) Strain and stress.
iii) Support Reactions.

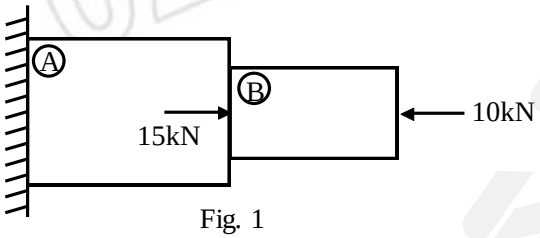

Fig. 1

OR

8. a) Derive and explain shape functions for a two noded 1-D bar member. **4**

b) For a step shaft shown in fig (2) having shear modulus of 180 GPa being subjected to for torques as shown in fig (2). Calculate. **10**

i) Angular displacements.
ii) Shear stress in each section.
iii) Support reactions.

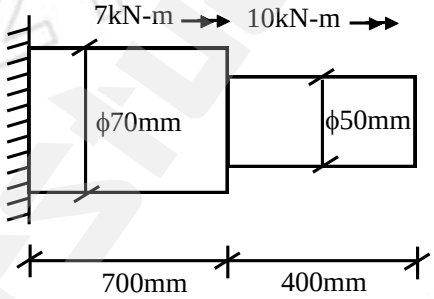

Fig. 2

9. For the truss shown in the fig (3) having members with cross-sectional area 400mm^2 and modulus of elasticity 200 GPa. **13**
Calculate the following.

i) Global stiffness matrix. ii) Nodal displacements.

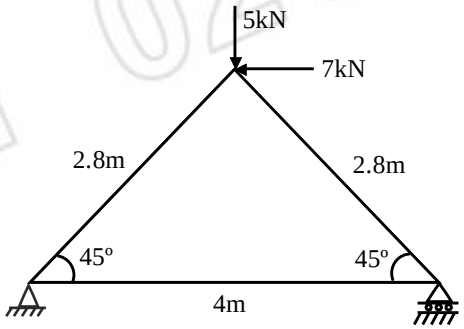

Fig. 3

OR

10. For a CST shown in fig (4) having thickness of 10mm and modulus of elasticity 210 GPa Calculate the following. **13**

i) Nodal displacement.

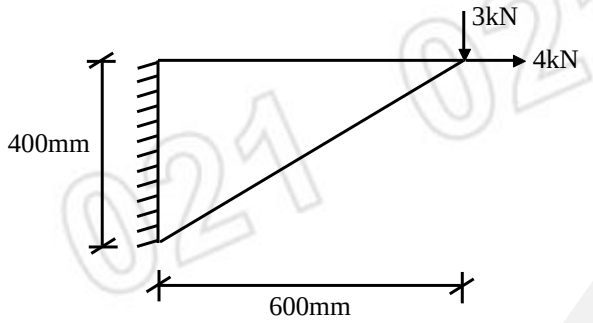

Fig. 4

11. a) Explain optimization and the steps of optimization in detail. **5**

b) A simply supported beam 90cm in length has a concentrated load of 8kN acting at its Centre. With a required factor of safety 1.65, design the beam for minimum deflection. For the following materials; **8**

i) SAE 3220 (Water quenched & drawn at 700ºC).
ii) SAE 2320 (Drawn 550ºC).
iii) SAE 9260.
iv) Muntz metal.

OR

12. A simply supported beam having rectangular Cross-section and length 950mm is subjected to a load of 8.5kN acting at the Centre of the beam. **13**

Design the beam with following specifications;
Factor of safety = 1.6
d/b ratio = k = 5.
Depth (d) should lie between 15mm and 150mm, solve the problem for minimum deflection. Using following material.

i) SAE 3120 (oil quenched). ii) SAE 1010.
iii) Aluminium 260.

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B.E. (Mechanical Engineering) Seventh Semester (C.B.S.)

Computer Aided Design (CAD)

P. Pages : 3 **NJR/KS/18/4613**

Time : Three Hours * 0 1 0 1 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
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6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use of design data book is permissible.

1. a) Explain the phases of computer aided design process and how it helps in conventional design process. **5**

b) Write Bresenham's algorithm for line generation for slope greater than one. **9**

OR

2. a) Write the Bresenham's algorithm to draw circle by deriving the necessary equations using algorithm generate the circle with radius equal to 5 on graph paper. **10**

b) Explain rasterization techniques. **4**

3. a) Explain what is mean by concatenation in transformation. **3**

b) A triangle ABC has its vertices at A(0, 0), B(5, 0) and C(3, 4). It is to be translated by 5 units x-direction and 2 units y-direction, then it is to be rotated in anticlockwise direction about the new position of point 'C' through 90º. Find the new position of triangle. **10**

OR

4. a) What is inverse transformation? Write inverse transformation matrix for translation, scaling and rotation. **5**

b) Find out the final position of line having end points (3, 4) and (8, 7), when it is translated by 4 units in y-direction, then scaled by 2 units in x & y direction and then rotated by 45º in clockwise direction. **8**

5. a) Explain Bezier curve along with its features. **5**

b) Construct the Bezier curve with 4 polygon vertices A(1, 1); B(2, 3); C(4, 3) and D(6, 4). Calculate the co-ordinates of points on the curve corresponding to the parameters : **8**

$t = 0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1$

OR

6. a) Discuss the assembly modeling in brief. **5**

b) Write short notes on **any two.** **8**

i) CSG technique.

ii) Boundary representation technique.

iii) Wire frame modeling.

7. a) Write various types of element, their number of nodes and number of degrees of freedom of each node. **4**

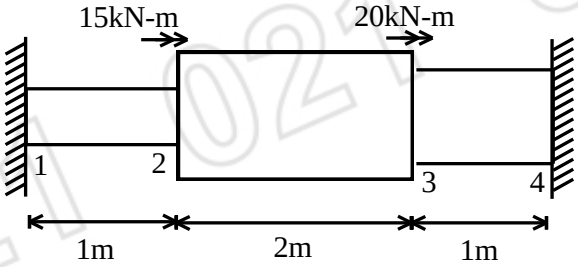
b) The stepped shaft as shown in figure is fully restrained against rotation about its axis. Twisting moments of 15 kN-m and 20 kN-m are applied at the point of changing cross-section. Calculate the rotations at nodes and reaction twisting moments at the ends of the bar. **10**

Take $G = 84\,GN/m^2$

$I_{P_1} = 1.5\times10^7\ mm^4$

$I_{P_2} = 2.5\times10^7\ mm^4$

$I_{P_3} = 2\times10^7\ mm^4$

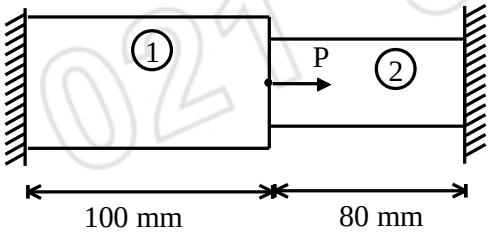


OR

8. a) Write properties of stiffness matrix. **4**

b) A horizontal bar consist of two steps as shown in figure. An axial load P = 10 kN is applied. Calculate **10**

i) Displacement at nodes.
ii) Stresses in each element.
iii) Reactions at the support.



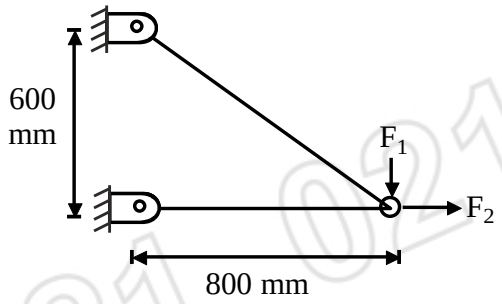
$D_1 = 40\,mm$ $D_2 = 30\,mm$

$E_1 = 200\,GPa$ $E_2 = 70\,GPa$

9. For the pin jointed configuration as shown in figure, subjected to force $F_1 = 50\,kN$ and $F_2 = 20\,kN$. Calculate **13**

i) Nodal displacement.
ii) Reaction at fixed support.

Take $E = 210\,GPa$; $A = 500\,mm^2$.



OR

10. a) Explain preprocessing and postprocessing in detail in finite element method. **8**

b) Derive stiffness matrix for CST element. **5**

11. A tensile bar is to be designed for minimum cost with following conditions : **13**
d > 12 mm ; Load, P = 60 kN
length, l = 500 mm & F.S. = 1.6
The cost of material to be used in design are as below
SAE 1030 – Rs. 18 per kg
SAE 3240 – Rs. 20 per kg
Al. Alloy – Rs. 22 per kg

OR

12. a) Discuss in brief adequate and optimum design. **4**

b) A simply supported beam having length 800 mm is subjected to load 10 kN at the centre. Design the beam for minimum deflection. Take factor of safety = 1.8. The available materials are SAE 1030, SAE 2340 (annealed); SAE 3145 (drawn at 425ºC) and SAE 4340 (cold rolled). **9**

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