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

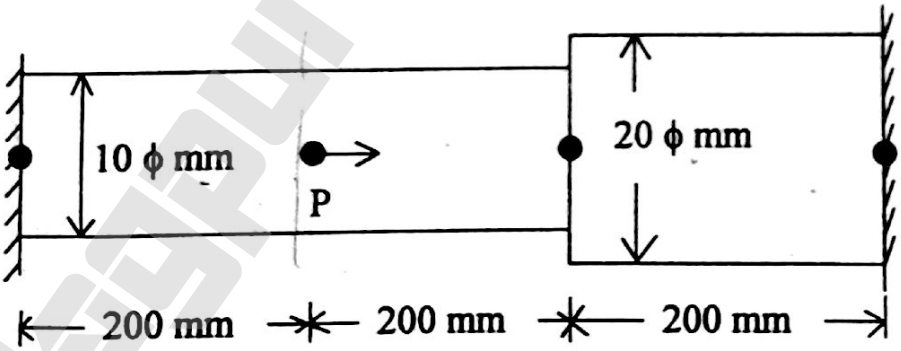
(b) For the three bar assemblage shown in Fig. 6(b) determine :

(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

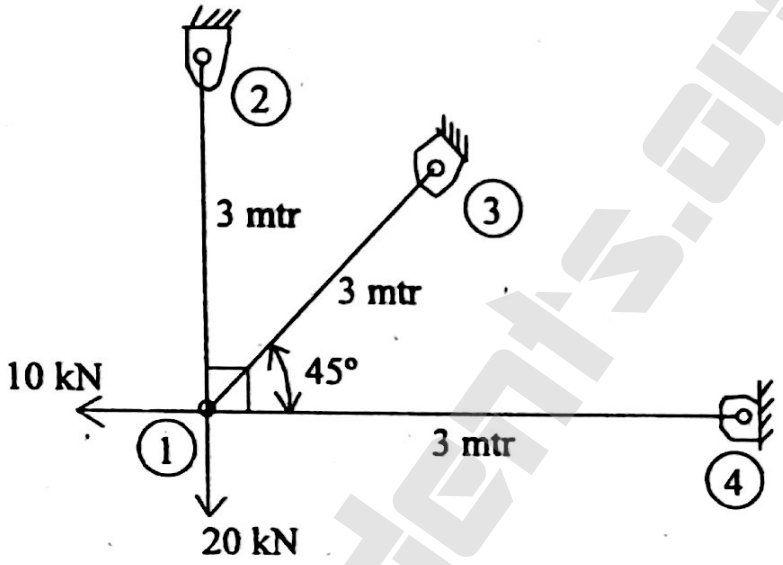


Fig. 7

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

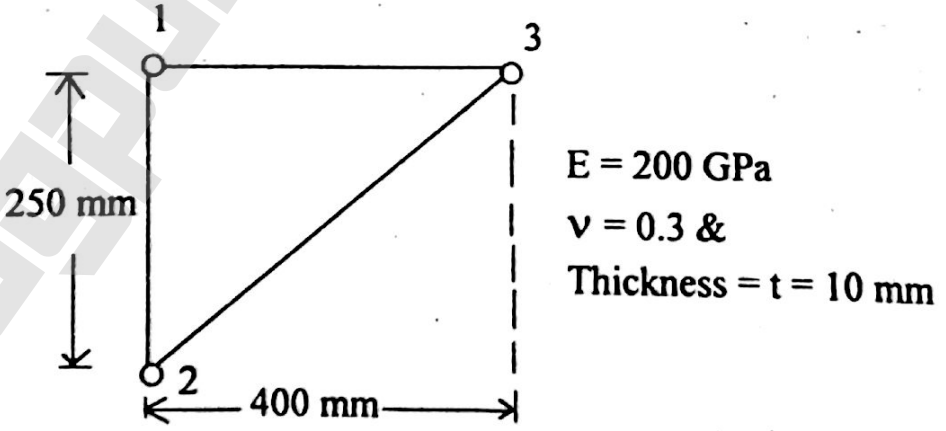
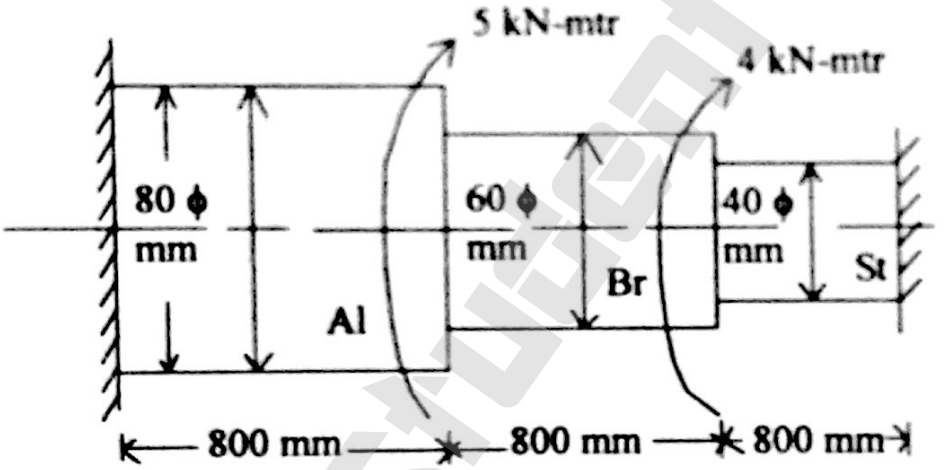


Fig. 8

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