SHANTILAL SHAH ENGINEERING COLLEGE
DEPARTMENT OF PRODUCTION ENGINEERING

Semester- VI

Subject Name - Computer Aided Design (2161903)

LIST OF EXPERIMENTS

SR NO	TITLE
1	Design report on introduction to cad and Introductory exercise for 3-D modeling
2	Design report on curves and surfaces and Exercise for 3-d editing options.
3	Design report on mathematical representation of solids and Exercise for Assembly modeling
4	Study of geometric transformation
5	Introductory exercise for finite element analysis.
6	Exercise for FEA of 1-D structural problems.
7	Exercise for FEA of trusses and beams.
8	Exercise for FEA of 1-D thermal problems.

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Prof. Dr. A.V. Gohil — Head of the Department

EXPERIMENT-1

DESIGN REPORT ON INTRODUCTION TO CAD AND INTRODUCTORY EXERCISE FOR 3-D MODELING

Sr. No.	Questions
1	Write Bresenham's algorithm for generation of line also indicate which raster locations would be chosen by Bresenham's algorithm when scan Converting a line from screen co-ordinate (1, 1) to (8, 5).
2	Discuss Breshnham's Circle algorithm with suitable example
3	Explain DDA algorithm for line generation with its limitations
4	Discuss the reason for implementing CAD. Also draw diagram showing product cycle with the implementation of CAD.
5	Write down differences between: Raster Scan and Vector Scan Displays
6	State the various CAD software commercially available and explain the features used to model Hexagonal nut.

EXPERIMENT -2

DESIGN REPORT ON CURVES AND SURFACES AND EXERCISE FOR 3-D EDITING OPTIONS.

Sr. No.	Questions
1	A Bezier curve is to be constructed using control points P0(35, 30), P1(25, 0), P2(15, 25) and P3(5,10). The Bezier curve is anchored at P0 and P3. Find the equation of the Bezier curve and plot the curve for u= 0, 0.2, 0.4, 0.6, 0.8 and 1.
2	Explain (i) Be'zier surface (ii) B-spline surfaces (iii) Coons surface
3	Line passing through the end points P1 (2, 7, 3) and P2 (6.26, -9.78, 13) in the direction given by the unit vector 0.213i -0.839j +0.5k. Find the coordinate of the mid-point of the line
4	Derive from fundamentals the parametric equation for the Hermite Cubic spline. Represent the equation in matrix form.
5	Explain analytic curves and synthetic curves with example.
6	For the position vectors P1 [3 7] and P2 [8 9], determine the parametric representation of line segment between them. Also determine the slope

EXPERIMENT -3

DESIGN REPORT ON MATHEMATICAL REPRESENTATION OF SOLIDS AND EXERCISE FOR ASSEMBLY MODELING

Sr. No.	Questions
1	Discuss: (i) Boundary representation (ii) Constructive solid Geometry representation
2	Enlist the various methods of geometric modeling. Differentiate between wireframe modeling and solid modeling technique
3	Write limitations of a wire frame model.
4	What is primitive instancing? Explain.
5	What do you understand by 2D, $2\frac{1}{2}$ D and 3D wire frame models?
6	With neat sketches explain the various Boolean operations used in solid modeling.

EXPERIMENT -4

STUDY OF GEOMETRIC TRANSFORMATION

Sr. No.	Questions
1	For ΔABC with coordinates A (5, 5), B (8, 5) and C (5, 10), find new vertex position if it reflected about a line y = 3x + 4.
2	A triangle PQR has its vertices at P (0, 0), Q (4, 0) and R (2, 3). It is to be translated by 4 units in x direction, and 2 units in y direction, and then it is to be rotated in anticlockwise direction about the new position of point R through 90 degree. Find new position of triangle.
3	A triangle ABC has vertices as A (2, 4), B (4, 6) and C (2, 6). It is desired to reflect through an arbitrary line L whose equation is y=0.5x+2. Calculate the new vertices of triangle and show the result graphically.
4	Write 3x3 transformation matrix for each of the following effects; (i). Scale the image to be twice as large and then translate it 1 unit to the left. (ii). Scale x direction to be half as large and then rotate anticlockwise by 90^0 about origin. (iii). Rotate anticlockwise about origin by 90^0 and then scale the x direction by half as large. (iv). Translate down 0.5 unit, right 0.5 unit, and then rotate anticlockwise by 45^0.
5	What is computer graphics? State general applications of computer graphics.
6	What is geometric transformation? Enlist its types.

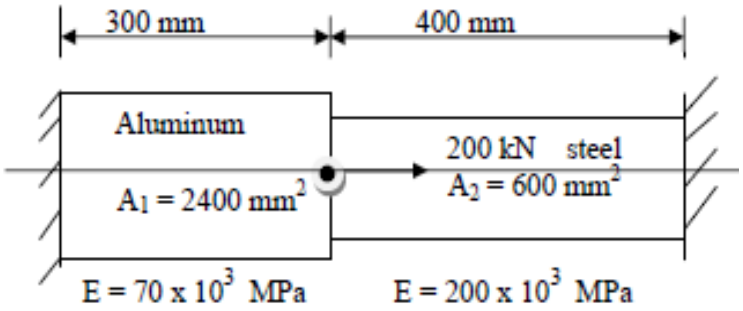
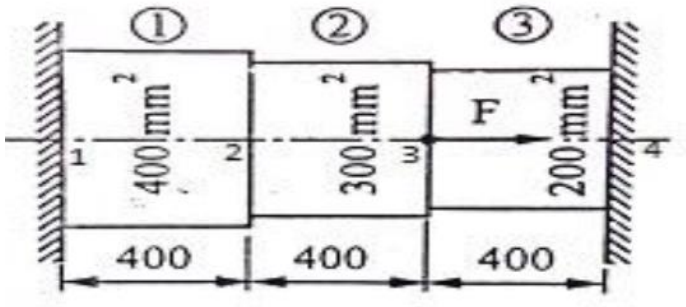
EXPERIMENT -5

INTRODUCTORY EXERCISE FOR FINITE ELEMENT ANALYSIS.

Sr. No.	Questions
1	What are the different types of meshes for FEM? Explain in brief
2	What is FEA? Explain steps involved in FEA.
3	Explain Penalty approach for FEA.
4	Discuss the properties of global stiffness matrix.
5	With reference to finite element analysis, discuss the treatment of boundary condition using elimination approach.

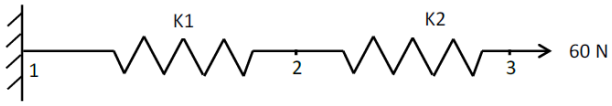
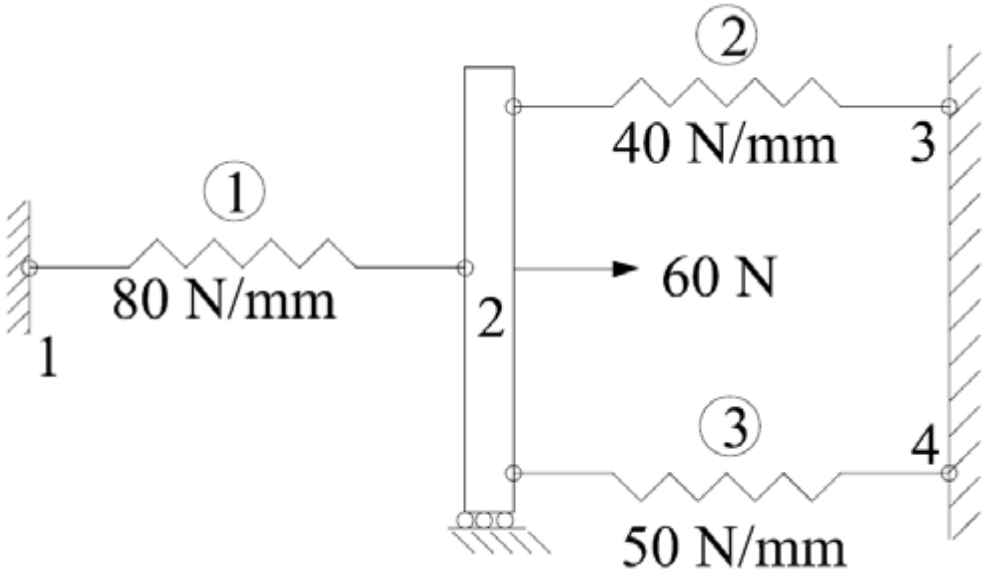
EXPERIMENT -6

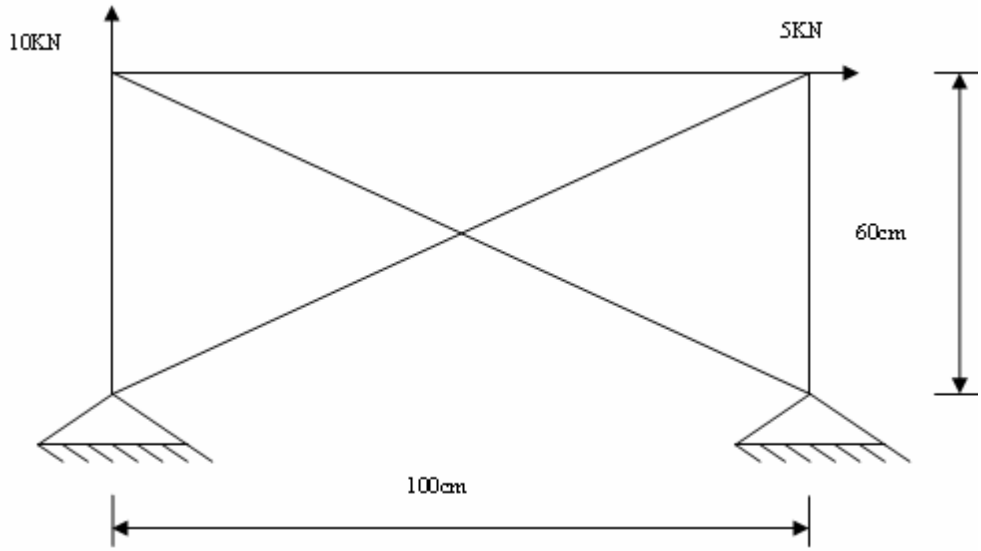
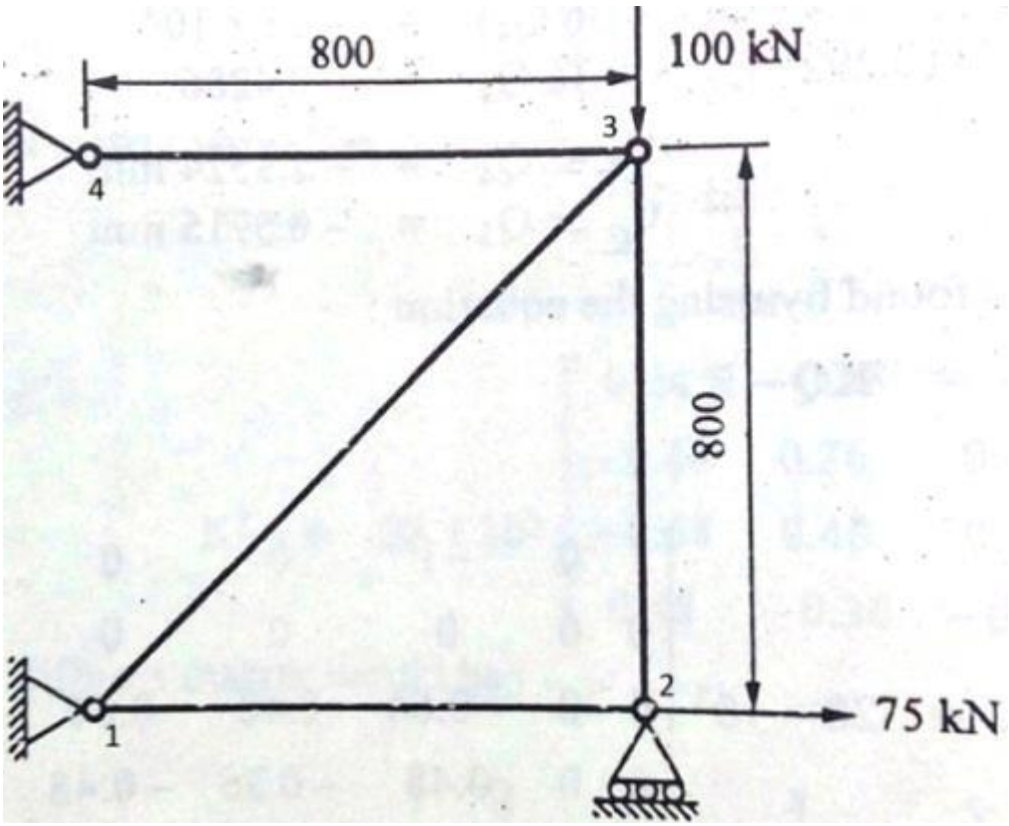
EXERCISE FOR FEA OF 1-D STRUCTURAL PROBLEMS.

1	Figure shows the compound section fixed at both ends. Estimate the reaction forces at the supports and the stresses in each material when a force of 200 kN is applied at the change of cross section. 
2	Consider the bar shown in figure-1. An axial load F=35 kN is applied as shown. Using **penalty approach** for handling boundary conditions, determine nodal displacements and support reactions. Take E=200 GPa for all elements. Length of each element is in mm.  Figure:1

EXPERIMENT -7

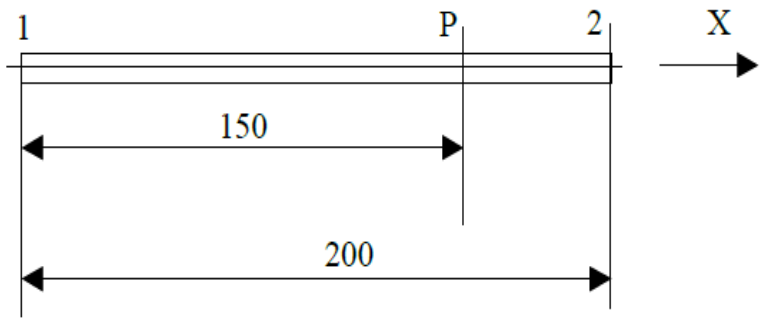
EXERCISE FOR FEA OF TRUSSES AND BEAMS.

1	Figure 3 shows two springs connected in series, having stiffness 12 and 8 N/mm respectively. One end of the assembly is fixed and a force of 60 N is applied at the end. Using finite element method; (i). Derive global stiffness matrix (ii). Derive global load vector (iii). Find displacement of all the nodes  Figure 3
2	A system of a rigid cart connected by three linear springs as shown in Fig.2. The force of 60 N is acting on cart as shown in figure. Determine the following: (1) Use finite element concept to assemble the elemental stiffness matrices of three linear springs into global stiffness matrix. (2) Write global load vector. (3) Find Nodal solution. 
3	A truss is made up of steel material with a bar size of 2 cm as shown in figure: Calculate: (i) Element stiffness matrix for each element

	(ii) Global stiffness matrix for entire truss 
4	A four bar truss is as shown in figure. Assuming that for each element, the cross-sectional area is 400 mm2 and modulus of elasticity is 200 GPa, determine the nodal displacements. Length of each element is in mm. 

EXPERIMENT -8

EXERCISE FOR FEA OF 1-D THERMAL PROBLEMS.

1	For one dimensional element shown in Figure 1, temperature at node 1 is 100^0C and at node 2 is 40^0C. Evaluate shape function associated with node 1 and node 2. Calculate temperature at point P. Assume linear shape function.  Figure 1
2	A two-step as shown in figure is subjected to thermal loading conditions. The length of left step is 250 mm & length of right step is 350 mm. An axial load P = 200 x 10^3 N applied 20°C to the end. The temperature of the bar is raised by 50°C. Calculate: (i) Element stiffness matrix (ii) Global stiffness matrix Consider E1 = 70 x 10^3 N/mm^2, E2 = 200 x 10^3 N/mm^2, A1 = 700mm^2, A2 = 1000 mm^2, α1 = 23 x 10-6 per °C and α2 = 11.7 x 10-6 per °C.