

noncommutative.

- b) Reflect the diamond shape polygon whose vertices are A (-1, 0), B (0, -2), C (1, 0) and D (0, 2) about the line $y = x + 2$. **07**

Q-5

Attempt all questions

- a) Explain B-spline curve and mention its advantages. **07**
b) Derive the equation for Bezier curve for four points using DeCasteljau algorithm. **07**

Q-6

Attempt all questions

- a) With reference to finite element analysis, discuss the treatment of boundary condition using elimination approach. **07**
b) Show in Figure 1 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

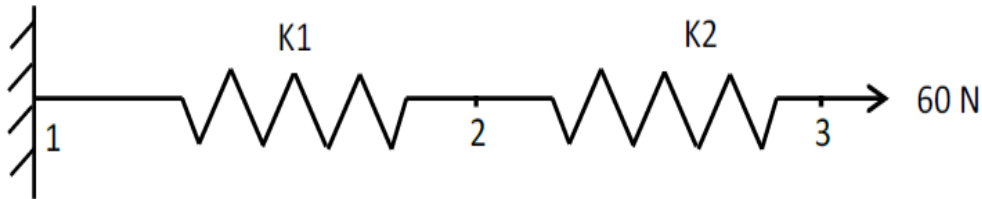


Figure 1

Q-7

Attempt all questions

- a) Explain the concepts of FEM. Discuss the different steps involved in FEA in detailed. **07**
b) A four bar truss is as shown in Figure 2. Assuming that for each element, the cross-sectional area is 400 mm^2 and modulus of elasticity is 200 GPa, determine the nodal displacements. Length of each element is in mm. **07**

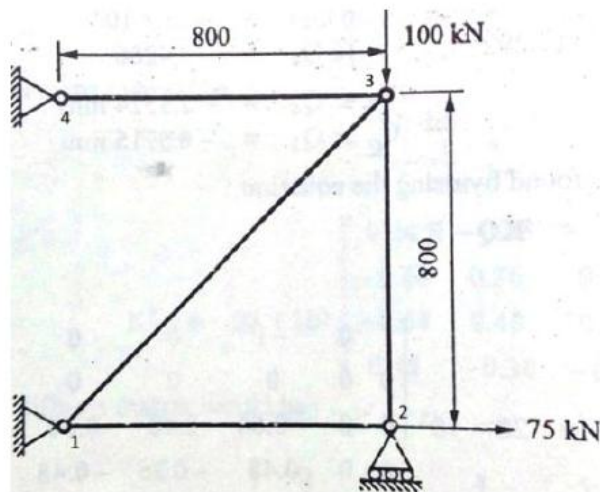


Figure 2



Q-8

Attempt all questions

- a) Discuss classification of optimization problem using suitable examples. **07**
- b) A Cylindrical shell of the heat exchanger is required to accommodate a total of 100 m length of standard diameter copper tubes. One meter square cross – sectional area inside the shell can accommodate 200 copper tubes. Design the heat exchanger shell with an objective of minimizing the cost of the heat exchanger, by using the following data:

Cost of the copper tubes = Rs. 20,000

Cost of the heat exchanger shell = Rs. 60,000 $D^{2.5} L$

Cost of floor space occupied by the heat exchanger = Rs. 10,000DL

Where, D = diameter of the heat exchanger shell in meter

L = length of the heat exchanger shell in meter.

