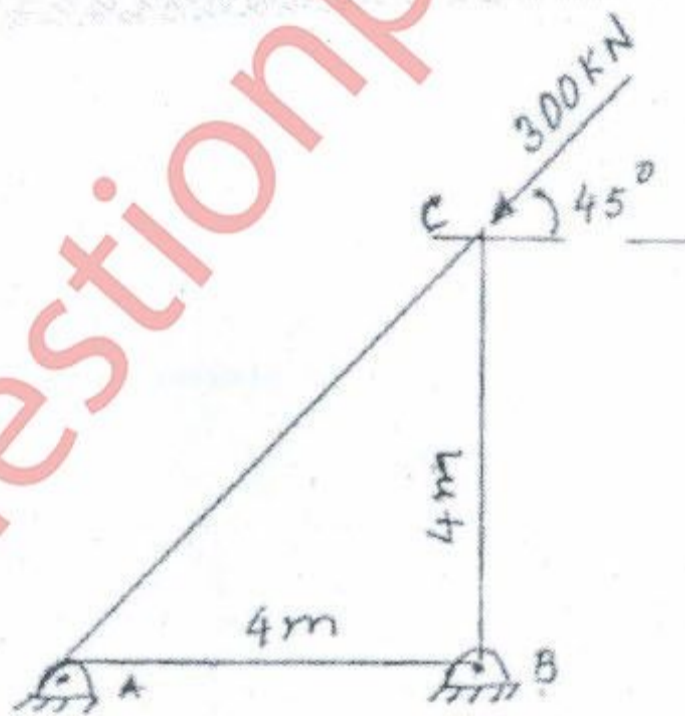


(3 Hours)

[Total Marks: 80]

- N.B. (1) Question No.1 is compulsory  
 (2) Answer any **three** questions out of the remaining **five** questions.  
 (3) Assume suitable data if necessary and state them clearly.  
 (4) Figures to the right indicate **Full Marks**.

- Q.1. Write Short notes on the following: -- 20  
 (a) 3D Transformations.  
 (b) Simple three nodes triangular element.  
 (c) Geometric Modelling.  
 (d) Sources of error in FEA solutions.
- Q.2. (a) Write a note on windowing and clipping. Explain Cohen-Sutherland algorithm for line clipping. 10  
 (b) Find the raster locations of a line from (2, 5) to (11, 13) using DDA algorithm. Also Draw a sketch showing all pixel locations. 10
- Q.3. (a) Consider a three member truss as shown in the figure below. All members of the truss have identical areas of cross section  $A = 400 \text{ mm}^2$  and  $E = 3 \times 10^5 \text{ N/mm}^2$ . Determine the horizontal and vertical displacement of point 'C' and reactions at the supports by using FEA. 15

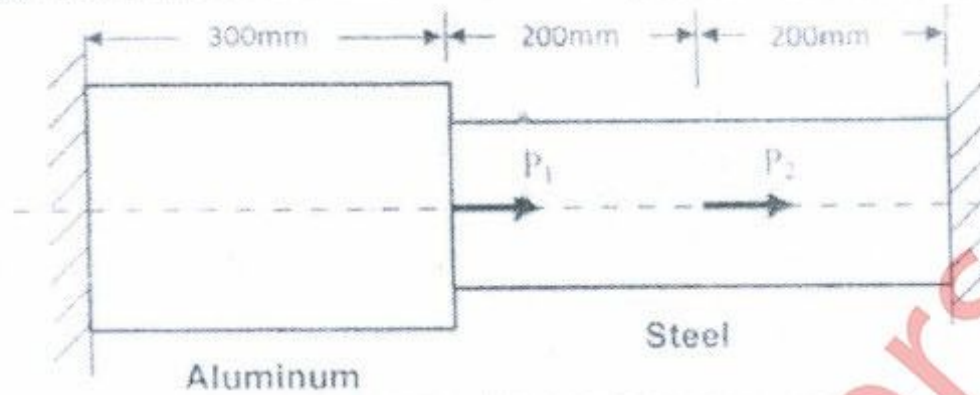


- (b) Explain quadratic shape function for 1 D element. 5
- Q.4. (a) Consider the bar shown in Figure below. An axial load  $P_1 = 200 \times 10^3 \text{ N}$ ,  $P_2 = 100 \times 10^3 \text{ N}$  is applied as shown. The area and modulus of elasticity for aluminium portion are  $A_{Al} = 2400 \text{ mm}^2$  and  $E_{Al} = 70 \times 10^9 \text{ N/m}^2$  respectively whereas for steel portion are  $A_{st} = 600 \text{ mm}^2$  and  $E_{st} = 200 \times 10^9 \text{ N/m}^2$  15

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respectively. The lengths of aluminium and steel portions are 300 mm and 400 mm respectively. The load  $P_1$  is applied at the start and  $P_2$ , midway on the steel portion. Using the elimination approach for handling boundary conditions, do the following:

- Determine the nodal displacements.
- Determine the stress in each material.
- Determine the reaction forces.
- Strain in each element.



- Explain different types of elements used in FEA. 5
- Q.5.
- Explain any one algorithm for polygon filling. 10
  - Find transformation of a quadrilateral A (1, 1), B (3, 2), C (4, 6), D (2, 5) by rotating  $45^\circ$  about origin and then translating one unit in x and y directions. 10
- Q.6. Write short notes on :- 20
- Merits and demerits of F.E.A.
  - Back face removal algorithm.
  - C.F.D.
  - Raster scan graphics.

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