PROD/V/CAD & FEA/CBGS/17-05-2017

Computer Aided Design & finite Element Analysis

(3 Hours)

[Total Marks : 80]

NB: 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.**

1.   **Write Short notes on the following :-**   20
        (a) Raster Scan Graphics.
        (b) Simple three nodes triangular element.
        (c) Comparison of wire frame modelling with solid modelling.
        (d) Penalty approach used in FEM.

2.   (a) Construct a Bezier curve of order '3' and with polygon vertices A(2, 2),   10
         B(4, 4), C(6, 4) and D(8, 3).

     (b) Compare DDA and Bresenham's algorithm taking your own example.   10

3.   (a) A three bar truss made of steel (E = 200 GPa) is subjected to the   15
         horizontal force of 15 KN and vertical force of 20 KN as shown in the
         figure below. The cross-sectional area of each element is 2000 mm².
         Using FEM, determine:-
         (i) The Nodal displacements.
         (ii) The stresses in each element.
         (iii) The reaction forces at the supports.
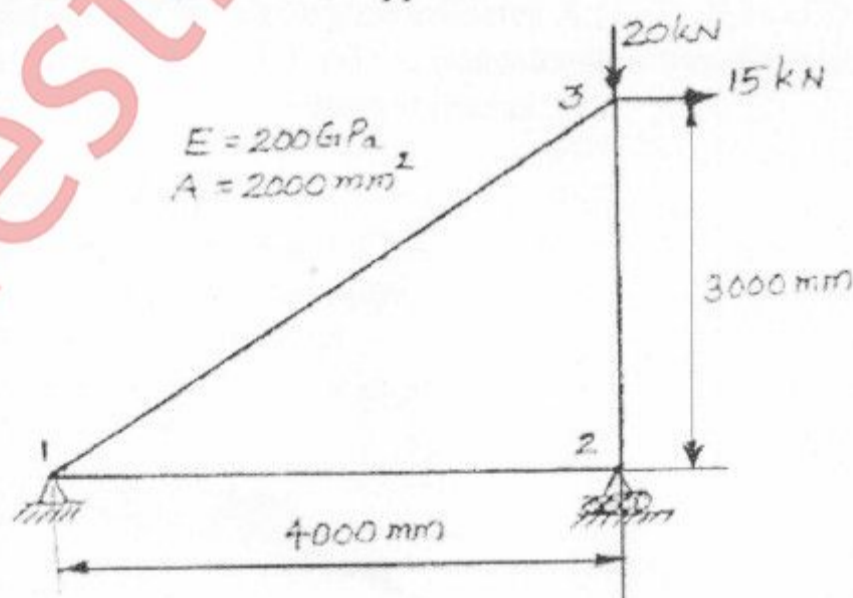
     (b) Explain quadratic shape function for I D element.   05

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4.   (a)   Consider the bar shown in Figure below. An axial load $P_1 = 20 \times 10^3$ **15**
Nand P_2 15×10^3 N is applied as shown. The modulus of elasticity is E
$= 210 \times 10^9$ N/m2 and diameters of the two portions are D1 $= 12$ mm
and D2 $= 8$ mm respectively. The lengths of the two portions are L1 $=$
20 cm and L2 $= 15$ cm respectively. The load P1 is applied at a distance
of 15 cm from the start of first element and P2 at the end of second
element. Using the elimination approach for handling boundary
conditions, do the following:
(a) Determine the nodal displacements.
(b) Determine the stress in each material.
(c) Determine the reaction forces.
(d) Strain in each element.

     (b)   Write a note on applications of FEA.   **05**

5.   (a)   Explain B-rep and CSG types of solid modelling with examples.   **10**
     (b)   Reflect a triangle ABC having coordinates A (1, 7), B (1, 10) and C (4,   **10**
10) about a line y = x + 4. Find the concatenated transformation matrix
and the coordinates of the reflected matrix.

6.   **Write short notes on :-**   **20**
(a) H-method and P-method in FEA.
(b) RGB and CMY colour models.
(c) Mesh compatibility in FEA.
(d) Functions of a graphics package.

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