

Please check that this question paper contains \_\_\_\_\_ questions and \_\_\_\_\_ printed pages within first ten minutes.

[Total No. of Pages: 3]

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Uni. Roll No. ....

Program: B.Tech. (Batch 2018 onward)

Semester: 5

Name of Subject: Finite Element Method

Subject Code: PCME-110

Paper ID: 16376

Scientific calculator is Allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

- a) For the bar element having 4 nodes, what will be order of [K] matrix.
- b) Differentiate between FEM and FDM.
- c) Write down the principle of minimum potential energy.
- d) Solve the following equations using Gauss elimination method.

$$X + Y = 3;$$

$$3X - 2Y = 4$$

- e) Draw the graph of variation of Quadratic Shape functions along the length of element.
- f) Why are Shape function used in FEM ?

Part – B

[Marks: 04 each]

- Q2. Find the K matrix for the truss element having end co-ordinates A (1,1) and B(5,5).
- Q3. What is node and explain its various types.
- Q4. Find the B matrix for Constant Strain Triangle Element having nodes A (0,0) B(1,1) C (1,0).
- Q5. Using Langrange method, find the shape functions values at P (0,0) for 3 node bar element having nodes at A (-2,0) B(1,0), C(4,0).
- Q6. Find the D matrix for stress - strain relation.

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Q7. If displacement field is described by following equations, determine  $\epsilon_x, \epsilon_y, \gamma_{xy}$  at  $x=1, y=1, z=1$  where  $U = (-x^2 + 2y^2 + 6xy)10^{-4}, V = (3x + 6y - y^2)10^{-4}, W = (z^2 + x^2 + y^2)10^{-4}$

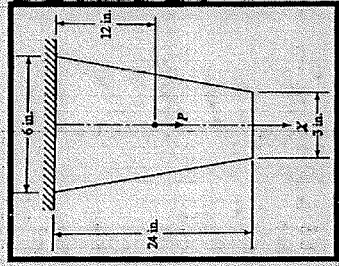
Part – C

[Marks: 12 each]

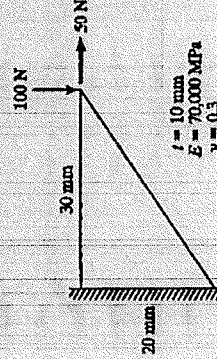
Q8. Derive the Shape Function for the four node quadrilateral element having nodes at each corner

OR

Consider the thin steel plate as shown in figure. The plate has a uniform thickness  $t=1$  in.,  $E=30 \times 10^5$  psi. Plate is subjected to a point load  $P=100$  lb at its midpoint. Using Elimination approach, solve for the global displacement vector Q.



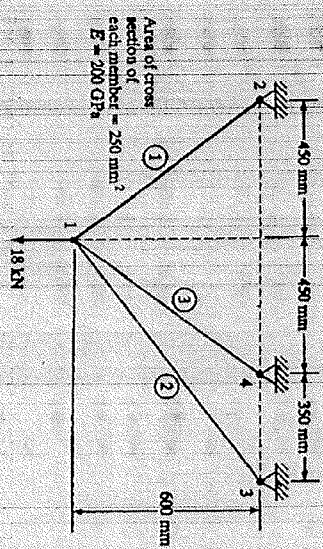
Q9. For the configuration shown in Figure below, determine the deflection at the point of load application using a one-element model. If a mesh of several triangular elements is used, comment on the stress values in the elements close to the tip.



OR

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For the three-bar truss shown in Figure below, determine the displacement of node 1 and the stress in element 3.



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