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Uni. Roll No.

Program: M.Tech. (ST)

Semester: 1/ (2019)

Name of Subject: Finite Element Method in Structural Engineering

Subject Code: MST-102

Paper ID: 16126

Time Allowed: 02 Hours

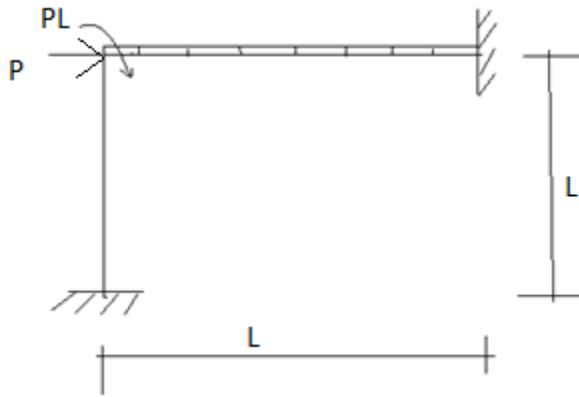
Max. Marks: 60

NOTE:

- 1) Each question is of 10 marks.
- 2) Attempt any six questions out of nine
- 3) Any missing data may be assumed appropriately

22-02-2022(M)

- Q1.** Analyze the frame shown in figure by element stiffness technique including the axial effects.

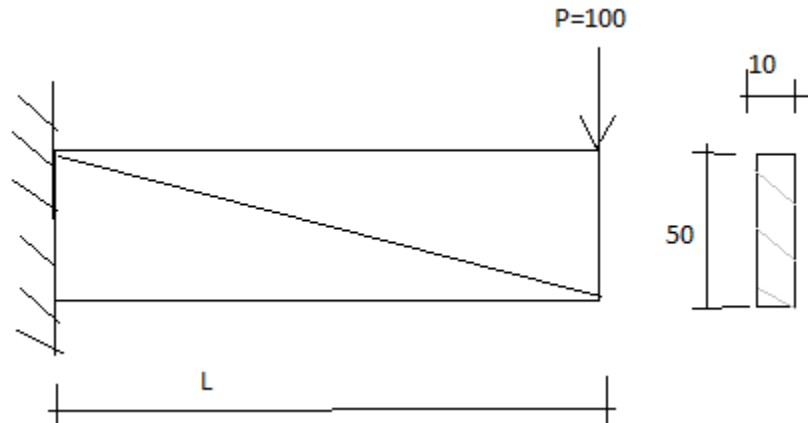


- Q2.** (a) What is discretization of a continuum? Discuss with the help of an example?
(b) Derive general finite element equation using principle of virtual displacement.
(c) Discuss the steps in finite element method.
- Q3.** (a) Discuss the organization of a finite element analysis program.
(b) Describe in detail the INPUT and OUTPUT for the above program for a plane stress and plain strain case with the help of an example.
- Q4.** (a) What are numerical integration techniques used in the finite element method.
(b) Using two point Gauss Quadrature calculate:

$$\int_{-1}^2 (2^3 + 3) dr$$

Q5. Calculate the stiffness of the quadrilateral from two triangles and analyze.

$E=10^6$, $\nu=0.3$, $L=200$ units



- Q6.** a) Assume right hand rule formulate the stiffness matrix of N noded plate element ($N \geq 3$)
 (b) Comment on the choice of order of numerical integration of the above element.
- Q7.** (a) Formulate the stiffness matrix for N noded solid element.
 (b) Discuss the compatibility modes in the above element.
- Q8.** (a) Derive the shape functions of four noded quadrilateral element.
 (b) Use numerical integration to calculate load vector of a quadrilateral element subjected to a pressure p on one of its edges.
- Q9.** Derive the shape functions for
 (a) Six noded quadrilateral element.
 (b) Eight noded serendipity quadrilateral element..
