Please check that this question paper contains 8 questions and02 printed pages within first ten minutes.

[Total No. of Questions: 08] [Total No. of Pages: ....]

Uni. Roll No. .....

Program: M.Tech. (Batch 2019 onward)
Name of Subject: Finite Element Method in Structural Engineering
Subject Code: MST-102
Paper ID: 16126

Time Allowed: 03 Hours **Max. Marks: 100**

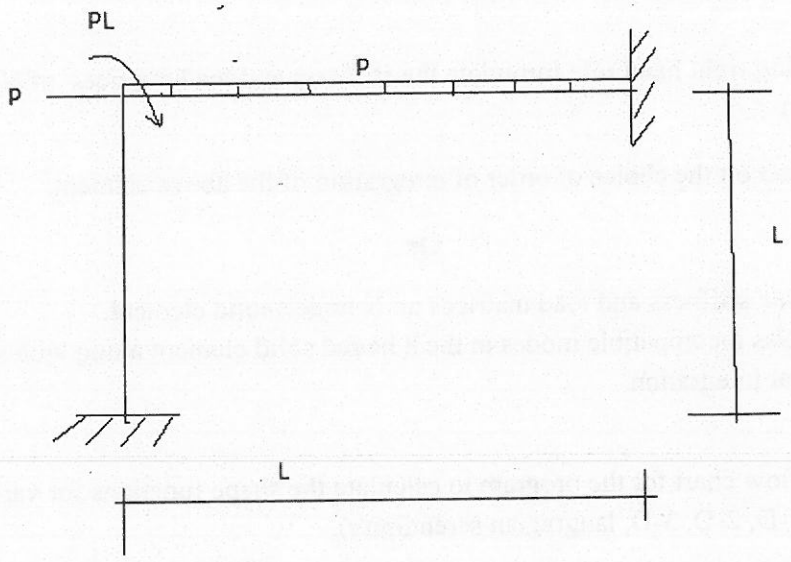
NOTE:
1) Attempt all questions
2) Any missing data may be assumed appropriately

Part-A (4 @ 5 = Marks)

Q1. What is the discretization of a continuum? Discuss with the help of an example.
Q2. Derive an equilibrium equation for a finite element and thus a continuum using strain energy method.
Q3. Discuss the steps in finite element method.
Q4. Derive the shape functions of 4 noded quadrilateral element.

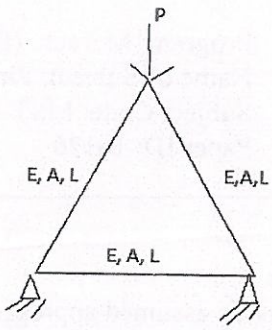
Part-B (4 @ 20 = 80 Marks)

Q5. Analyses the structure shown by element stiffness technique.



Or

Using finite element method analyse the truss and validate your results.



Q6. (a) Deduce the shape functions of a triangular element from the above relations.

(b) Use numerical integration to calculate the load vector of a quadrilateral element subjected to a pressure p on one of the edges.

Or

(a) What are the numerical integration techniques are used in the finite element method. Discuss Gauss Quadrature method in detail. Also discuss its limitations.
(b) Using two point Gauss Quadrature calculate:

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

Q7. (a) assuming right hand rule formulate the stiffness and load matrices of N noded plate element (N≥3)

(b) Comment on the choice of order of integration of the above element.

Or

(a) Formulate stiffness and load matrices on N noded solid element.
(b) Discuss incompatible modes in the 8 noded solid element along with suitability of numerical integration.

Q8. Draw the flow chart for the program to calculate the shape functions for various types of the elements (1-D, 2-D, 3-D, langragian serendipity).

Or

Describe the principle of Virtual Work and Vibrational Principle. Discuss its application in the finite element formulations.
b. Describe Weighted Residual Method.

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