

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination November 2018

B. Tech. (ME/CSE/CSE-IBM) Engineering, Semester V

Roll No.....

COURSE CODE: ID504

Time: 3 hours

Max. Marks: 80

COURSE TITLE: FINITE ELEMENT ANALYSIS

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. A symmetric structure can be analyzed by modeling one symmetric part
 - (a) Depending on applied loads
 - (b) Depending on boundary conditions
 - (c) Depending on applied loads and boundary conditions
 - (d) None of these
- ii. A spring element is similar to.....element
 - (a) Truss
 - (b) Beam
 - (c) Pipe
 - (d) None of these
- iii. Number of shape functions for a triangular plane stress element are
 - (a) 2
 - (b) 3
 - (c) 4
 - (d) 6
- iv. Number of terms in the displacement function in relation to the number of nodes in that element is
 - (a) More
 - (b) Equal
 - (c) Less
 - (d) Unrelated
- v. Order of stiffness matrix for a plane stress model with 20 nodes is
 - (a) 10
 - (b) 20
 - (c) 40
 - (d) 60
- vi. For a beam element, which of the following relations is true?
 - (a) $N_1 + N_2 + N_3 + N_4 = 1$
 - (b) $N_1 + N_3 = 1$
 - (c) $N_1 + N_2 = 1$
 - (d) $N_1 = N_4$
- vii. Choose the incorrect statement from the following:
 - (a) The member of an ideal truss carries out only axial loads.
 - (b) Frames never have pin joints.
 - (c) Statically indeterminate frames can be analyzed by finite element method.
 - (d) Stiffness matrix for a truss is never negative definite.
- viii. The general finite element equation is given by
 - (a) $F = k \cdot u$
 - (b) $F = k / u$
 - (c) $F = k \cdot u^2$
 - (d) None of these
- ix. Name the methods are generally associated with the finite element analysis?
 - (a) Force method
 - (b) stiffness method
 - (c) displacement method
 - (d) All of them
- x. How do you calculate the size of the global stiffness matrix?

Q.2 Short answer type questions (4 questions @ 2.5 marks)

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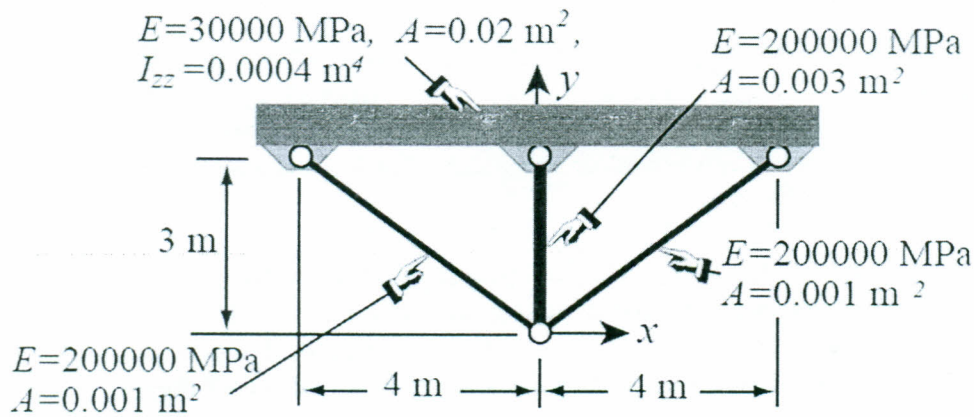
Q.2A Explain Pascal Triangle.

Q.2B What is a CST element? Give some examples.

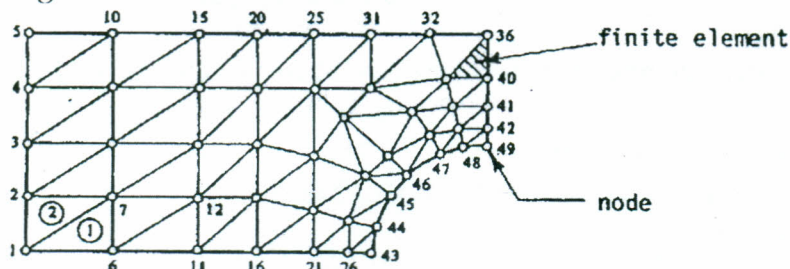
Q.2C List any five popular software FEA packages.

Q.2D State the properties of the global stiffness matrix.

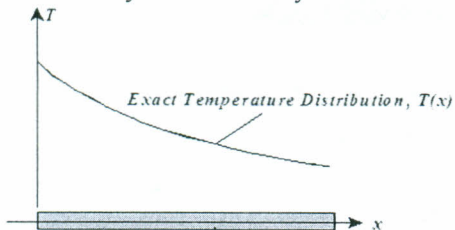
Q.3A Derive the master stiffness equation using DSM steps for the following figure. 05



Q.3B Explain nodes, elements and Mesh element. Write the nodes and elements for the given structures as below 05



Q.4A What do you mean by Discretization? Discretize the following curve. 05

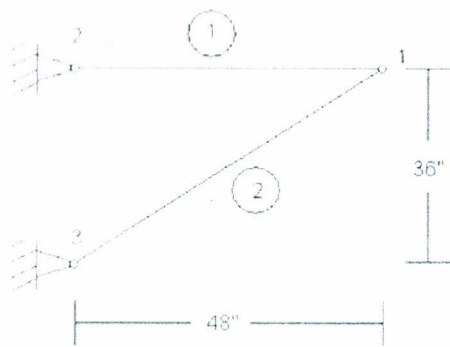


Q.4B What is axisymmetric element? What are the conditions for a problem to be axisymmetric? 05

Q.5A Briefly explain the steps involving in FEA for 2D structures problem. 05

Q.5B Briefly explain how problem involving infinite bodies are handled in finite element analysis. 05

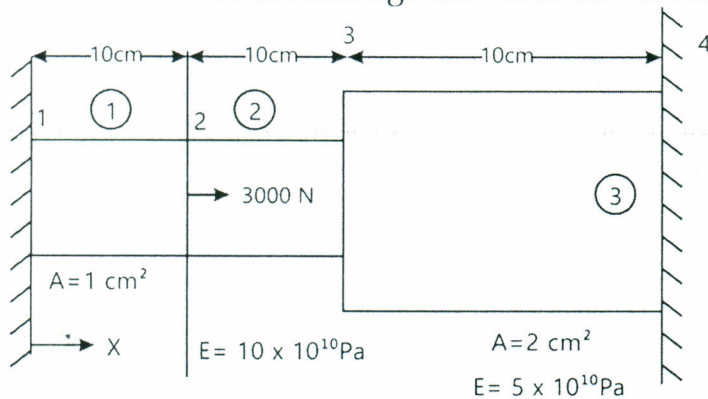
Q.6A Consider the truss structure presented in the following figure: 05



Develop the coordinate table then calculate displacements and reaction forces.

Q.7 For the three bar assemblage shown in the following figure

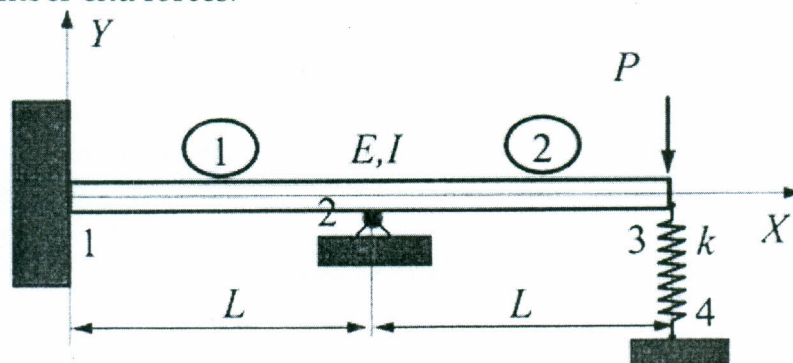
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Determine the assembled (global) stiffness matrix, the displacement at nodes 2 and 3 and the reaction at nodes 1 and 4.

Q.8 Write differences between bar and beam. Then, find the slope, deflection, reactions and member end forces.

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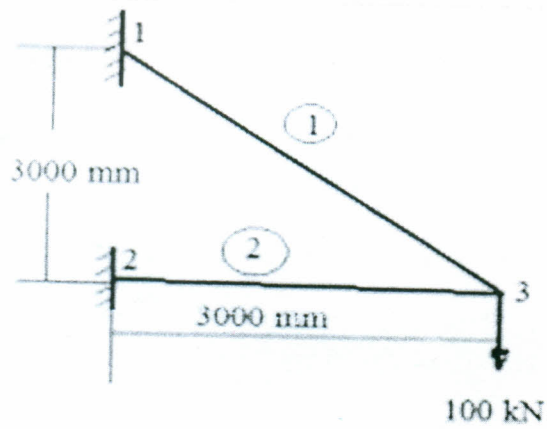
Given: $P = 50 \text{ kN}$, $k = 200 \text{ kN/m}$, $L = 3 \text{ m}$,

$E = 210 \text{ GPa}$, $I = 2 \times 10^{-4} \text{ m}^4$.

OR

Q.8 (a) What is a truss? State the assumptions made while analyzing the truss? For the two-bar truss shown in figure, determine the displacements and stress. $A_1 = 500 \text{ mm}^2$, $A_2 = 1200 \text{ mm}^2$, $E = 2 \times 10^5 \text{ N/mm}^2$.

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- (b) Writes short notes on
(i) Boundary Condition and (ii) Errors in FEA