Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Even) Semester Examination May-June 2025

Roll no.....

Name of the Program and semester: B. Tech VI sem
Name of the Course: Finite Element Method
Course Code: TME 614

Time: 3 hour

Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (CO1) (2X10=20 Marks)

a. What do you understand by discretization finite element method? Discretize this geometry into ten elements and explain why you did that discretization.

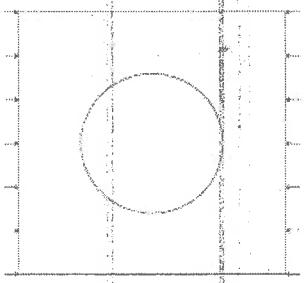
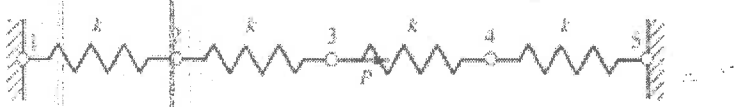


Plate with a Hole

b. Explain post processing in finite element procedure?
c. What are the key applications of finite element method?

Q2. (CO1, CO2) (2X10=20 Marks)

a. What is a spring element? How many nodes and dimensions does it have and how are the forces applied on it? Can it support bending?
b. How do you treat non-homogeneous boundary condition?



c.
Determine nodal displacements, stress in elements and reaction force.

Q3. (CO3) (2X10=20 Marks)

a. Derive the matrix to represent a vector in a rotated coordinate system in 2D.
b. Determine the displacement components of node 3, the reaction force components at nodes 1 and 2, and the element displacements, stresses, and forces. The elements have modulus of elasticity $E1 = E2 = 10 \times 1.06$ lb/in^2 and cross-sectional areas $A1 = A2 = 1.5$ in^2.

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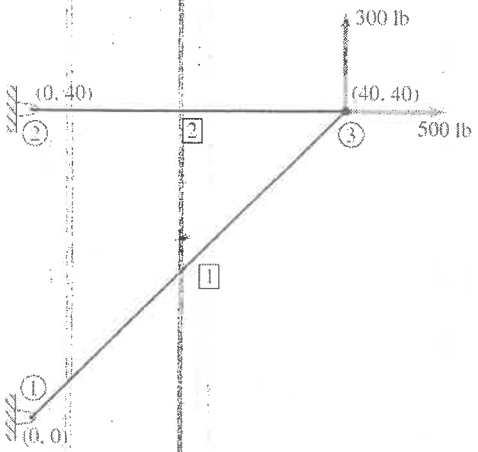
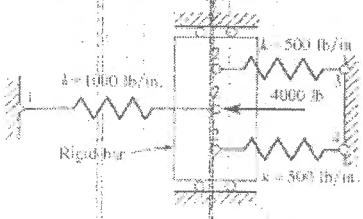


c. Determine the global stiffness matrix for the system below.



Q4. (CO4, CO5) (2X10=20 Marks)

a. Draw a diagram of beam element, explain why it has four degrees of freedom? Can it take bending loads?

b. Combine two beam elements to form a simply supported beam. Derive the global stiffness matrix.

c. Combine two beam elements to form cantilever beam. Derive the global stiffness matrix.

Q5. (CO5, CO6)(2X10=20 Marks)

a. Explain what is a plane stress problem.

b. How many degrees of freedom does a triangular element has? Explain with diagram.

c. Why does a bar element has four degrees of freedom in 2D plane?

Note For the question paper setters:

- Question paper should cover all the COs of the course.
- Please specify COs against each question.