Printed Page:-04 **Subject Code:- AMTME0211**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech

SEM: II - THEORY EXAMINATION (2024- 2025)

Subject: Advanced Finite Element Analysis

Time: 3 Hours **Max. Marks: 70**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 15

1. Attempt all parts:-

1-a. Which method is commonly used for formulating FEM mathematically? (CO1, K1) 1

(a) Variational and Weighted residual approaches

(b) Differential equations

(c) Algebraic equations

(d) Geometric equations

1-b. Which property of materials is considered in plate bending problems with anisotropic materials using FEM? (CO2, K1) 1

(a) Directional stiffness

(b) Isotropic conductivity

(c) Uniform density

(d) Homogeneous elasticity

1-c. What are the limitations of relying on idealized stiffness in beam elements for analyzing beam-slab problems? (CO3, K1) 1

(a) Neglects local deformations

(b) Ignores global structural behavior

(c) Assumes linear material properties

(d) Increases computational complexity

1-d. What role does mesh generation play in Finite Element Analysis? (CO4, K1) 1

(a) It discretizes the domain into smaller elements

(b) It specifies boundary conditions

(c) It solves numerical equations

(d) It optimizes computational efficiency

1-e. What advantage does Finite Element Method (FEM) offer in terms of design optimization compared to conventional analysis methods? (CO5, K1) 1

(a) Allows for detailed exploration of design space

(b) Limits design exploration opportunities

(c) Increases reliance on simulation tools

(d) Requires extensive computational resources

2. Attempt all parts:-

2.a. What do yean by Discretization? (CO1, K1) 2

2.b. What is meant by axisymmetric analysis in FEM? (CO2, K1) 2

2.c. What is meant by “idealization” in structural modeling? (CO3, K1) 2

2.d. What is the significance of computer graphics in FEA? (CO4, K1) 2

2.e. What is the output of a typical FEM simulation? (CO5, K1) 2

SECTION-B 20

3. Answer any five of the following:-

3-a. What are the advantages and disadvantages of using FEM over FDM? (CO1, K1) 4

3-b. What are the applications and limitation of FEM? (CO1, K1) 4

3-c. Discuss plate bending problems under FEM with focus on isotropic vs. anisotropic material behavior. (CO2, K2) 4

3-d. State the important considerations when modeling heat conduction using FEM. (CO2, K2) 4

3.e. What are the boundary conditions taken to solve the simply supported beams problem using FEM? (CO3, K2) 4

3.f. What are the challenges in data preparation for FEA? (CO4, K2) 4

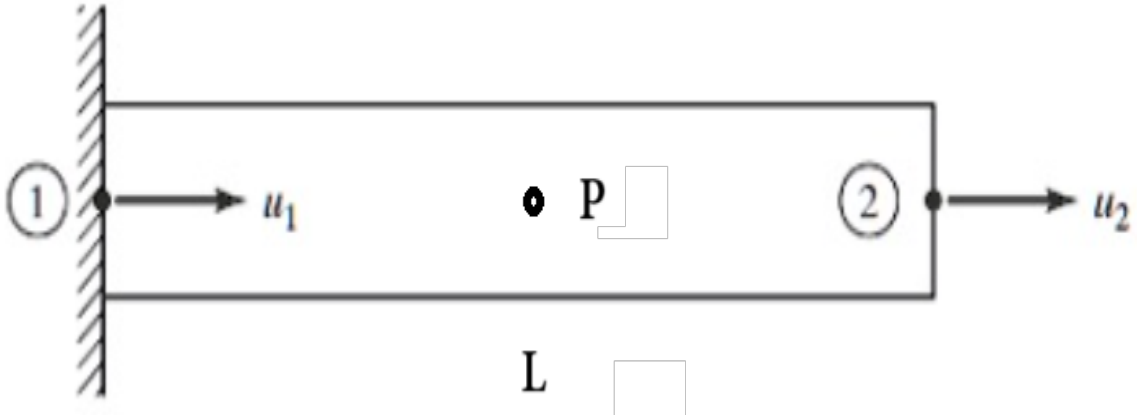
3.g. What is the basic purpose of integrating FEM with CAD? (CO5, K2) 4

SECTION-C 35

4. Answer any one of the following:-

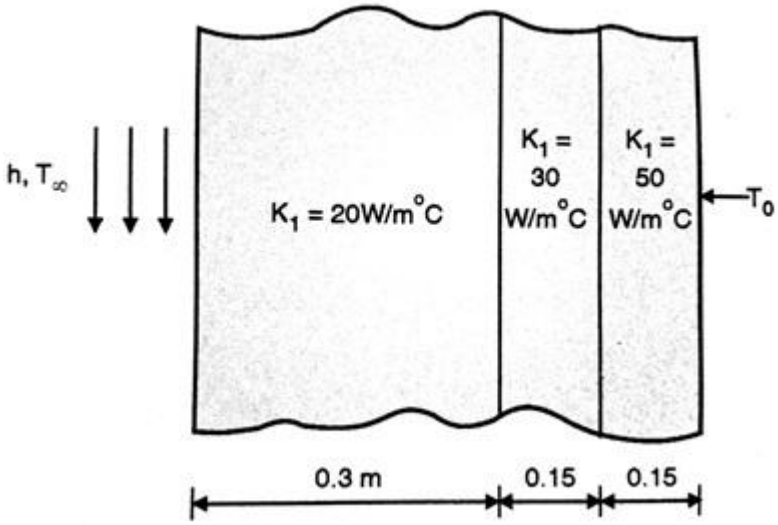
4-a. Write short notes on the following method to solve FEM problem: (CO1, K2) 7
(a) Galerkin method
(b) Weighted residual method

4-b. Find the nodal displacement of a mid-point P of a bar of length L whose one end is fixed. (CO1, K3) 7



5. Answer any <u>one</u> of the following:-

5-a. A composite wall consisting of three material as shown in figure. The outer temperature is To = 20°C, convection heat transfer takes place on the inner surface of the wall Tco = 800°C and h = 25 W/m^2°C. Determine the temperature distribution in the wall. (CO2, K3) 7

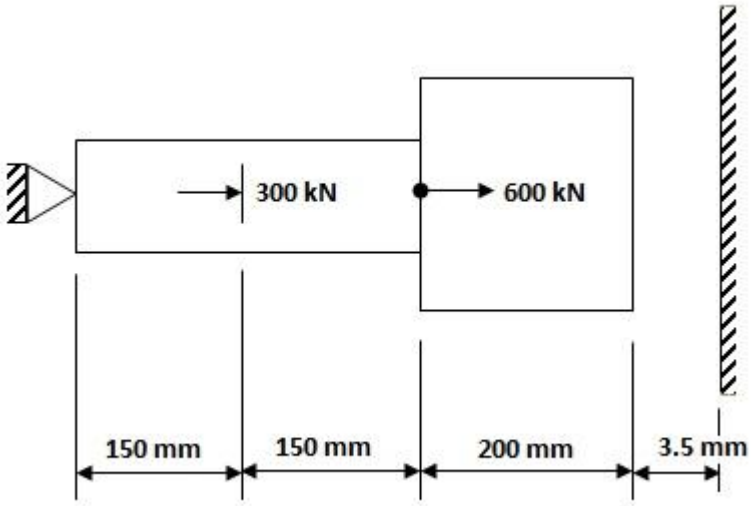


5-b. The nodal coordinates of triangular element are P_1 (1, 2), P_2 (5, 3), and P_3 (4, 6). The *x* coordinate of inner point P is (3, 3) and shape function N_1 = 0.3. Determine N_2, N_3 and *y* coordinate of the point P. (CO2, K3) 7

6. Answer any <u>one</u> of the following:-

6-a. Determine the element stiffness matrix for a simply supported beam of length L subjected to point load at mid of beam. (CO3, K3) 7

6-b. Determine the nodal displacements, element stresses and support reactions for the bar shown in figure below. The cross-sectional areas are 250 mm^2 and 400 mm^2. Young modulus E = 200 x 10^9 N/m^2. (CO3, K3) 7



7. Answer any <u>one</u> of the following:-

7-a.	What are the different types of elements? How does the choice of element type affect the accuracy of a finite element model? Explain in brief. (CO4, K2)	7
7-b.	Describe the function of the preprocessor and postprocessor in an FEA program. (CO4, K2)	7

8. Answer any <u>one</u> of the following:-

8-a.	What are the features are desirable in FEM packages for solving engineering problems? Also explain general purpose vs special purpose programs in FEM. (CO5, K2)	7
8-b.	Describe a complete case study or example where FEM was used to refine or validate an existing product design which include meshing, boundary conditions, and results interpretation. (CO5, K2)	7

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