

Date: 16/05/2017.

Student Exam No. _____

Ganpat University
M.Tech II SEM (CAD/CAM) Mechanical Engineering
3ME211 Finite Element Method
CBCS (NEW) Regular Examination April – June 2017

Duration: 3hr

Marks: 60

Instructions:

1. Assume suitable data if necessary.
2. Write your answer to the point and precisely.
3. Draw neat and clean sketch.

SECTION - 1

Q.1 Attempt following questions.

- (a) Solve the following equation using two-parameter trial solution by Galerkin's method. [10]

$$\frac{dy}{dx} + y = 0, \quad 0 \leq x \leq 1$$

$$y(0) = 1$$

- (b) Write down the procedure for determining solution using Galerkin's method.

OR

Q.1 Attempt following question.

Determine the nodal displacement of node 1 and the stresses in each element for problem as shown in Figure 1. Let $E = 210 \text{ GPa}$ and $A = 10^{-3} \text{ m}^2$ for all elements. [10]

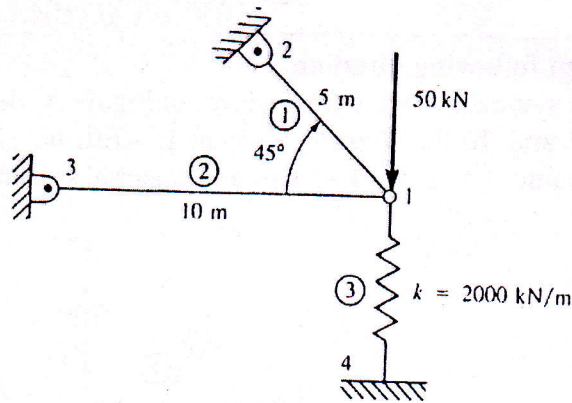
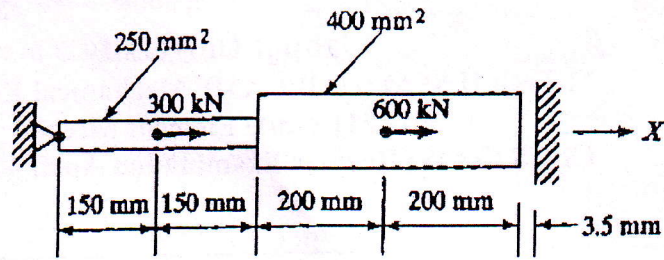


Figure 1

Q.2 Attempt following question.

Determine the displacements and stresses in each of step of bar as shown in Figure 2, for temperature rise of $50 \text{ }^\circ\text{C}$. [10]



$$E = 200 \times 10^9 \text{ N/m}^2$$

Figure 2

OR

Q.2 Attempt following questions. [10]

- Write a short note on point collocation method to solve the differential equation of engineering problems.
- Derive the element stiffness matrix and force matrix using Potential Energy approach for 3D truss element.

Q.3 Attempt following questions. (Any Two) [10]

- Write a short note on Penalty approach to treat the boundary condition.
- How temperature effect is considered in FEM problem? Explain in detail.
- What is numerical integration? How it is used to determine the stiffness terms? Show by some sample example.

SECTION – II

Q.4 Attempt following question. [10]

For the symmetric plane truss shown in Figure A, determine (a) the deflection of Node 1 and (b) the stress in element 1. AE/L for element 3 is twice AE/L for the other. Let assume $A = 1 \text{ m}^2$, $L = 1 \text{ m}$ and material is aluminium. Convert P into SI system of units.

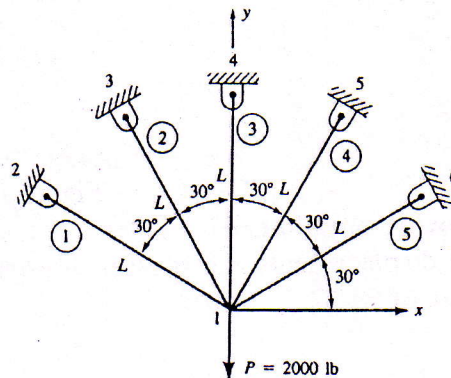


Figure A

OR

Q.4 **Attempt following question.** **[10]**
Determine the displacement solution for simply supported beam by two point collocation method. Write down boundary condition for it and beam is subjected to uniformly distributed load of q_0 .

Q.5 **Attempt following question.** **[10]**
Heat is generated in a large plate at the rate of 4000 W/m^2 . The plate is 25 cm thick. The outside surfaces of the plate are exposed to ambient air at 30°C with a convective heat-transfer coefficient of $20 \text{ W/m}^2 \text{ }^\circ\text{C}$. Determine the temperature distribution in the wall. Thermal conductivity of material $k = 0.8 \text{ W/m }^\circ\text{C}$.

OR

Q.5 **Attempt following questions.**

(a) Derive the element matrix and equations for heat conduction problem using minimum potential energy principal. **[07]**

(b) What are the scalar field problems? List field variables, parameters and boundary conditions for various scalar field problems. **[03]**

Q.6 **Attempt following questions.(Any two).** **[10]**

(a) Write down general steps for solving problem using FEA with practical example.

(b) Derive the element matrix and equations for torsion problem using Galerkin Approach.

(c) What is shape function? Explain linear shape function.

END OF PAPER