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Question Paper Code	11838

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Sixth Semester

Mechanical Engineering

(Common to Production Engineering)

ME8692 - FINITE ELEMENT ANALYSIS

(Regulations 2017)

Duration: 3 Hours Max. Marks: 100

Answer ALL Questions

PART - A (10 × 2 = 20 Marks)

		Marks, K-Level, CO
1.	State the methods of engineering analysis.	*2,K1,CO1*
2.	Why polynomial types of interpolation functions are mostly used in FEM?	*2,K1,CO1*
3.	Define Body Force.	*2,K1,CO2*
4.	List the Characteristics of shape Functions.	*2,K1,CO2*
5.	Differentiate CST and LST elements.	*2,K2,CO3*
6.	Write the governing differential equation for two dimensional heat transfer.	*2,K1,CO3*
7.	List the required conditions for a problem assumed to be axisymmetric.	*2,K1,CO5*
8.	Differentiate material non linearity and geometric non linearity.	*2,K2,CO4*
9.	Discuss the purpose of isoparametric elements.	*2,K2,CO6*
10.	Differentiate natural coordinates and local coordinates?	*2,K2,CO6*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Find the deflection at the centre of a simply supported beam of span length "l" subjected to uniformly distributed load throughout its length as shown in figure.1 using a) point collocation method, b) sub-domain method, c) Least squares method, and d) Galerkin's method. *13,K3,CO1*

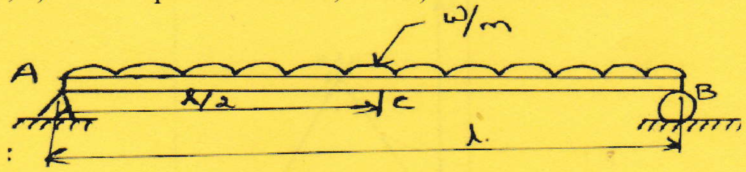

Fig.1

OR

b) (i) Briefly describe the general steps of the finite element method. *9,K2,CO1*

(ii) Enumerate the advantages, disadvantages and applications of FEM. *4,K2,CO1*

12. a) For a tapered plate of uniform thickness t = 10mm as shown in figure.2. Find the displacements at the nodes by forming in to two element model. The bar has mass density ρ = 7800Kg/m^3 Young's modulus E = $2\times10^5 MN/m^2$. In addition to self weight the plate is subjected to a point load P = 10KN at its centre. Also determine the reaction force at the support. *13,K2,CO2*

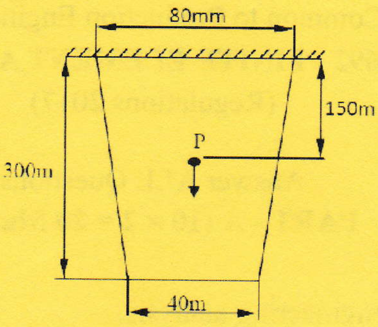

Fig.2

OR

b) Find the deflection at the point load and the slopes at the ends for the steel shaft which is simply supported at the bearing A and B as shown in Figure.3. *13,K2,CO2*

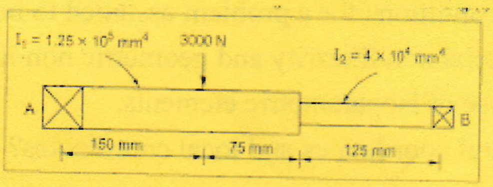

Fig.3

13. a) Evaluate the element stiffness matrix for the triangular element shown in Figure.4. Under plane stress conditions. Assume the following values E=2 X 10^5 N/mm^2 *13,K3,CO3*

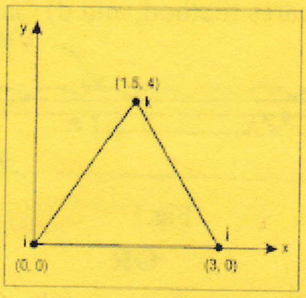

Fig.4

OR

b) Compute the element matrix and vectors for the element shown in Figure.5. When the edges 2-3 and 3-1 experience convection heat loss. *13,K3,CO3*

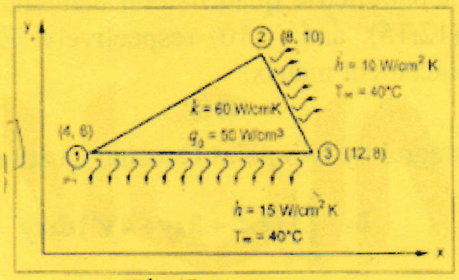

Fig.5

14. a) Calculate the element stiffness matrix and the thermal force vector for the axisymmetric triangular element shown in figure.6. The element experiences a 15^0c increase in temperature. The co-ordinates are in mm. Take $\alpha = 10 \times 10^{-6}/^0c$; $E = 2\times 10^5\ N/mm^2$, $\nu = 0.25$. *13,K3,CO4*

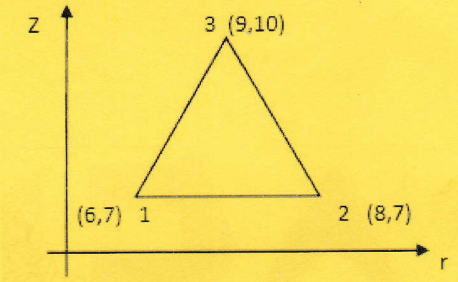

Figure.6

OR

b) Derive the shape function for the constant strain triangular element. *13,K2,CO4*

15. a) Evaluate the Cartesian coordinate of the Point P which has local coordinates $\varepsilon=0.6$, $\eta= 0.8$ as shown in Figure.7 *13,K3,CO5*

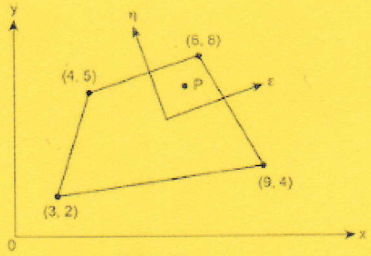

Fig.7

OR

b) Derive the shape functions for 4-noded rectangular element by using natural coordinate system. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Consider the isoparametric quadrilateral element with nodes 1 to 4 at (5,5), (11,7), (12,15), and (4,10) respectively. Estimate the Jacobian and strain displacement matrix. *15,K3,CO6*

OR

b) Evaluate the integral by two point Gausian Quadrature. *15,K3,CO6*

$$I = \int_{-1}^{1}\int_{-1}^{1} (2x^2 + 3xy + 4y^2)\, dx\, dy$$

The gauss points are + 0.57735 and -0.57735 each of weight 1.000.