Total No. of Questions : 8]

SEAT No. :

PF5027

[Total No. of Pages : 3

[6626]-165
T.E. (Mechanical)
COMPUTER AIDED ENGINEERING
(2019 Pattern) (Semester - VI) (302050)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) An axial load of 400 kN is applied at 20 °C to the rod as shown Figure 1. The temperature is then raised to 50 °C. **[12]**

Property	Element 1	Element 2
Material	Aluminium	Steel
Modulus of Elasticity	70 GPa	200 GPa
Area	900 mm^2	1200 mm^2

Formulate:

i) Element stiffness matrix $[k_1]$, $[k_2]$

ii) Global stiffness matrix [K]

Determine using elimination approach:

i) Nodal displacement $[u_1]$, $[u_2]$, $[u_3]$

ii) Element Stresses $[\sigma_1]$, $[\sigma_2]$

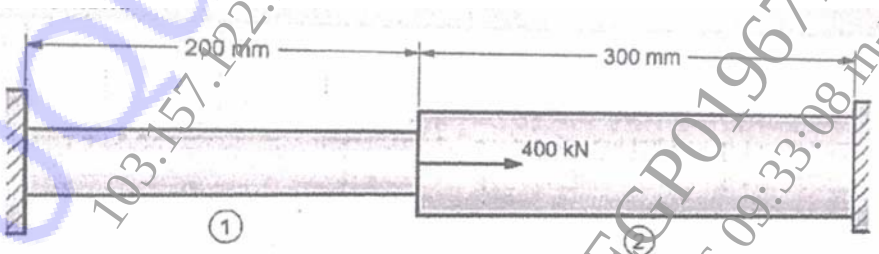


Figure 1

b) Discuss thermal effects in one dimensional element. **[6]**

OR

P.T.O.

Q2) a) For the two-bar truss shown in Figure 2 below. All the elements have E = 200 GPa and A= 1000 mm^2. Assuming points 1 and 3 are fixed. Formulate: **[12]**

i) Element stiffness matrix $[k_1]$, $[k_2]$

ii) Global stiffness matrix [K]

Determine using elimination approach:

i) Nodal displacement vectors at node 2 $[u_3]$ $[u_4]$

ii) Element Stresses in element 1 $[\sigma_1]$

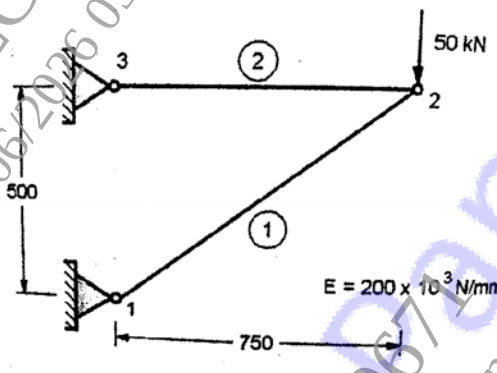


Figure 2

b) Derive the stiffness matrix in brief using the principle of minimum potential energy approach. **[6]**

Q3) a) The nodal coordinates of the triangular element are (1, 2), (5, 3) and (4, 6). At the interior point P, the x-coordinate is 3.3 and the shape function at node 1 is 0.3. Determine the shape functions at nodes 2 and 3 and also the y-coordinate at the point P. **[8]**

b) Determine the shape functions for a CST element. Show that they are nothing but area coordinate. **[8]**

OR

Q4) a) In Post-processing of Computer Aided Engineering (CAE). **[10]**

i) How to validate and check accuracy of the result

ii) Interpretation of Results and Design Modifications

b) Write a short note on CAE reports **[6]**

Q5) a) Explain the following terms in Non-linear analysis. **[10]**

i) Solution Techniques for Nonlinear analysis

ii) Essential steps in Nonlinear analysis

b) Explain stress-strain measures for non-linear analysis. **[8]**

OR

Q6) a) Explain Free vibrations. Write down the boundary conditions in free vibration analysis with its solutions methodologies. **[10]**

b) What is Dynamic analysis? Write down the comparison of static and dynamic finite element analysis. **[8]**

Q7) a) Illustrate the Crash analysis with explicit and implicit integration schemes. **[10]**

b) Illustrate the CAE based applications in Computational Fluid Dynamics (CFD). **[8]**

OR

Q8) a) Describe the significance of durability and reliability of any mechanical component used in finite element-based fatigue analysis. **[10]**

b) Elaborate the CAE based applications in casting and sheet metal simulations. **[8]**

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