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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 20AE5DEFEM **Max Marks: 100**
Course: Finite Element Method **Date: 14.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Differentiate between normal and shear stress. State a loading type for each the above stress. **5**

b) State and explain maximum normal stress theory of failure. Also mention for which materials it is applicable. **5**

c) For the spring shown in Fig. 1c, determine the nodal displacements at points 1, 2 and 3. **10**

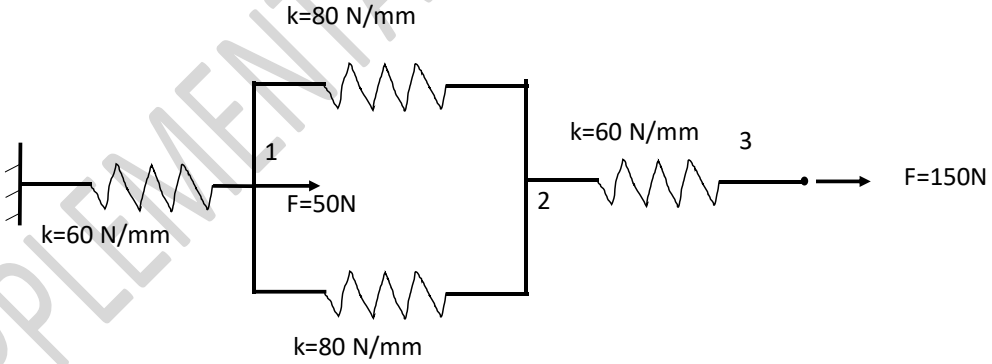

Fig. 1C

OR

2 a) Most of the 3-D structural analysis is done with geometry idealization to 2-D. Stating the two idealizations, explain the stress and strain fields in each of these cases. **8**

b) For the beam shown in Fig. 2b obtain the maximum deflection using Rayleigh-Ritz method. **12**

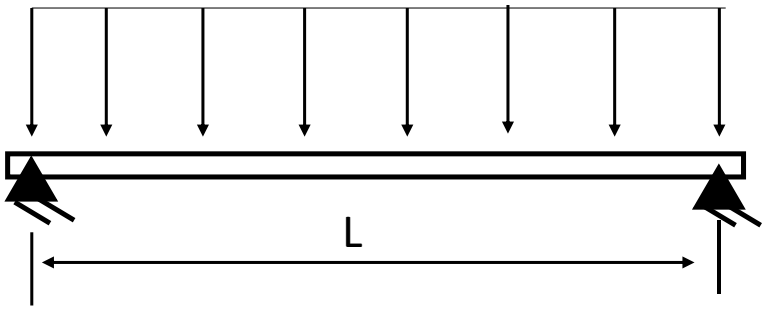

Fig. 2b

UNIT - II

3 a) For the stepped bar shown in Fig. 3a, determine the strains and stress in the elements. Also estimate the reaction forces. **14**

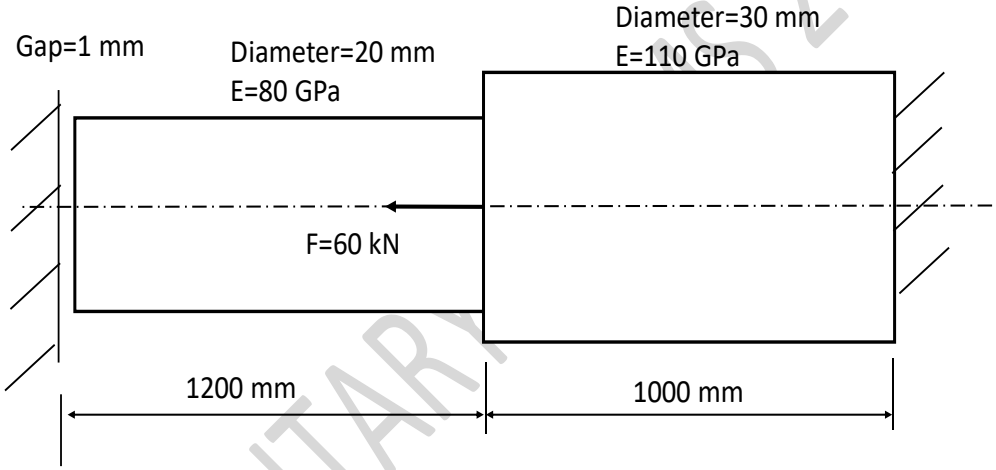

Fig. 3a

b) What are shape functions? Discuss the shape functions used for Quadratic element. **6**

UNIT - III

4 a) For the truss shown in Fig. 4a, determine the nodal displacements, element strains and stresses. The material of the truss is Aluminium with a Young's modulus of 78 GPa. **15**

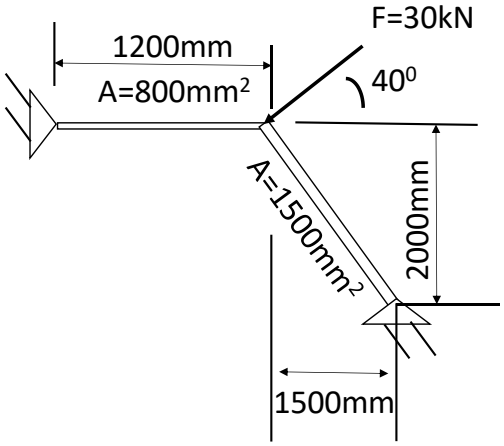

Fig. 4a

b) Differentiate between bar and truss elements. **5**

OR

5 a) For the beam shown in Fig. 5a, estimate the deflection and slope at the mid-span. **16**

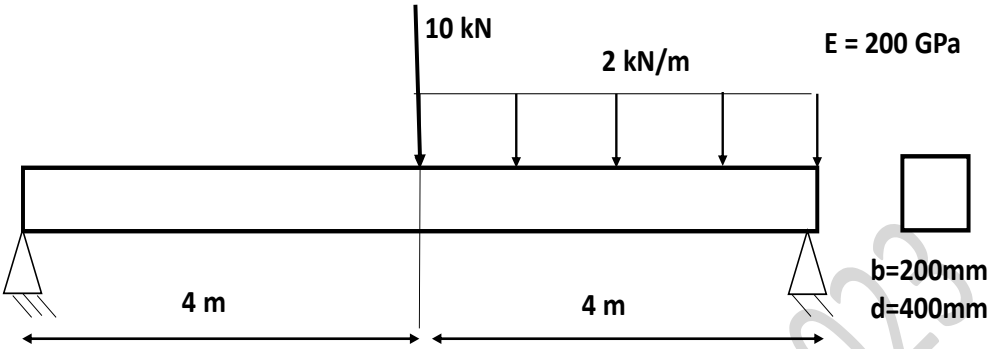

Fig. 5a

b) Describe the hermite shape functions used for beam formulation. **4**

UNIT - IV

6 a) Derive the strain-displacement matrix for CST element with usual notations. **12**

b) Bring out the importance of Convergence criteria and different methods to achieve the convergence. **5**

c) What is an axi-symmetric element? Describe. **3**

UNIT - V

7 a) Write the element mass matrix for the bar and CST elements. **5**

b) For the wall of furnace is shown in Fig. 7b, convection heat transfer takes at the inner side of the wall with the convection heat transfer coefficient of 28 W/m^2 ^{o}C. Determine the temperature distribution in the composite wall. **15**

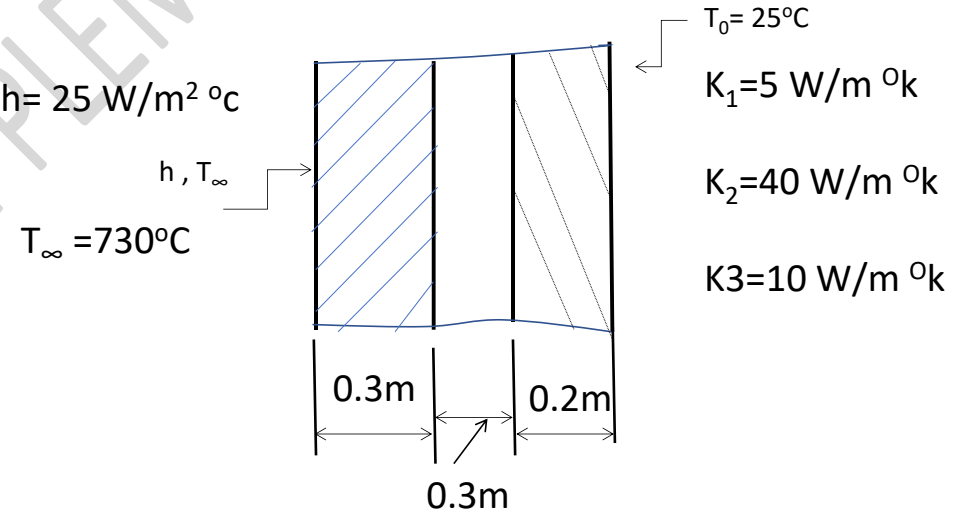

Fig. 7b

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