Code No. 14765/CBCS

FACULTY OF ENGINEERING

B.E. (M/P) VII-Semester (Main & Backlog) Examination, March/April 2021

Subject : Finite Element Analysis

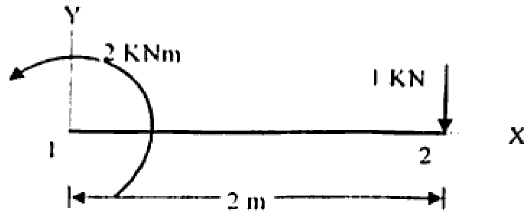
Time: 2 hours **Max. Marks: 70**

Note: Missing Data, if any, may be suitably be assumed.

PART – A

Answer any five questions. **(5x2 = 10 Marks)**

1 What are the properties of stiffness matrix?
2 State the principle of minimum potential energy.
3 Write the stiffness matrix for plane frame element.
4 Determine the load vector for the beam element shown in figure.

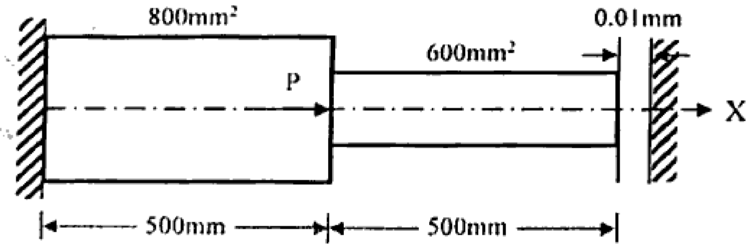


5 State strain – displacement relations for a plane strain problem.
6 In a plane stress problem, σ_x=100 MPa, ε_y=0.001, E = 200 GPa and v=0.25. Determine the normal strain in z-direction (ε_z).
7 Differentiate between isoparametric and subparametric elements.
8 What is meant by isoparametric formulation?
9 What are the convergence requirements of finite element method?
10 What are the properties of eigen vectors?

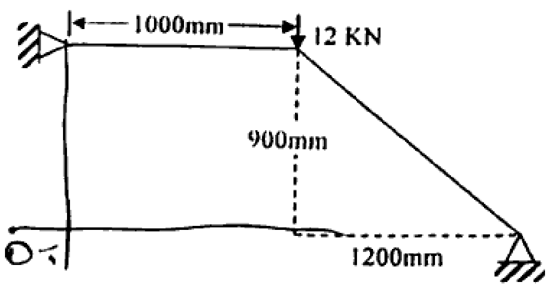
PART – B

Answer any four questions. **(4x15=60 Marks)**

11 For the stepped bar shown in figure 1, determine the nodal displacements and element stresses. Take E = 70 GPa, P = 50kN, $\alpha = 20 \times 10^{-6}/^0$ C and $\Delta T = 50^0$ C.



12 Find the nodal displacements and element stresses in the truss shown in figure 2. Take E = 200 GPa, A = 600 mm² for all members.



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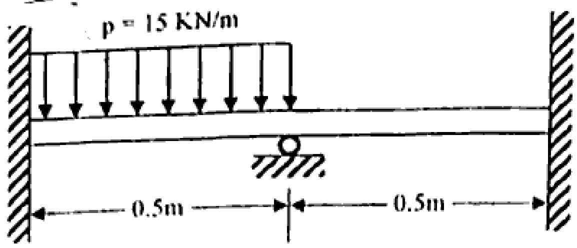
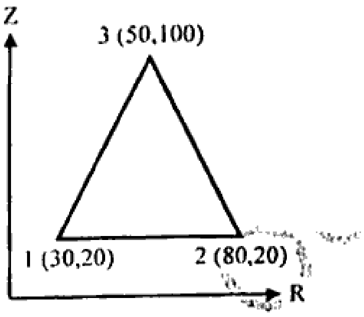
13 For the beam shown in figure 3, determine the deflection and slope if E = 200 GPa and I = 5×10^4 mm^4.



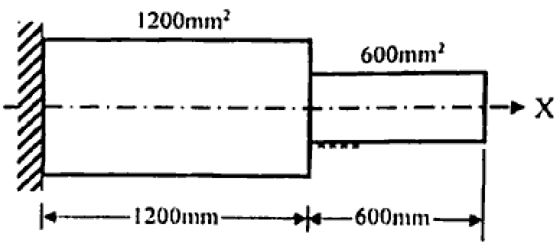
14 (a) Derive the strain displacement matrix for a 3- noded triangular element.
(b) Determine the element stiffness matrix for the axisymmetric triangular element shown in figure 4. Take E = 210 GPa and v = 0.25.



15 (a) Derive the shape functions for 4-noded quadrilateral element using natural coordinates.
(b) What is numerical integration? Explain in brief about Gauss quadrature method.
(c) What are global, local and natural coordinates?

16 Determine the temperature distribution in the circular fin of diameter 1 cm and length 8 cm. Base of the fin is maintained at 100 ^{0} C and convection takes place throughout the surface including the tip. The ambient temperature is 20^{0} C. Assuming the fin has two linear elements. Take k=2 W/cm^{0} C and h=0.2 W/cm^{2} ^{0} C.

17 Determine the eigen values and eigen vectors for the stepped bar shown in figure 5. Take E = 200 GPa and ρ = 7500 kg/m^3.



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