$\square$

PART - B
9. Determine stiffness matrix of 2-noded axial bar element using potential energy approach.
10. Explain the equilibrium state of the system, when the system is subjected to different types of loads and explain the stress and equilibrium relations.
[10M]
11. Obtain the stiffness matrix of a 2-noded beam element starting from Hermite shape functions.
12. Find the expression for element stiffness matrix for two dimensional truss element.
[10M]
13. Determine the element stiffness matrix and nodal load vectors, nodal displacement matrix for a CST element.
[10M]
14. Determine the shape functions for a 8 node quadratic quadrilateral element (boundary noded).
[10M]
15. The coordinates of a 3 -noded triangle thermal element are $1(1,1), 2(10,4)$ and $3(6,7)$. The corresponding nodal temperatures are 120,140 and 80 respectively in ${ }^{0} \mathrm{C}$. Assuming linear temperature within the element. Compute temperature at a point P whose coordinates are $(7,4)$.
[10M]
16. A shaft of rectangular cross section of dimensions $8 \mathrm{~cm} \times 6 \mathrm{~cm}$ is having quarter symmetry when subjected to out of plane twisting moment. Compute the global stiffness matrix assuming that the quarter of the rectangular cross section is divided into two triangle elements of equal size.
[10M]
17. A beam of span 2 L is fixed at both ends. Determine the frequencies of natural vibrations of this beam. The elastic modulus, density, area of cross-section and area moment of inertia are $\mathrm{E}, \rho, \mathrm{A}$ and I respectively. Take two elements and use lumped mass matrix.
[10M]
18. Differentiate lumped mass matrix and consistent mass matrix. Give application of FEM in analyzing the dynamic field problems.
[10M]

