B.E. MECHANICAL ENGINEERING

FOURTH YEAR SECOND SEMESTER EXAM, 2022

Finite Elements for Dynamics and Non-linearity

Time : Four hours **Full Marks: 70**

All questions carry equal marks

Q1. (a) Discuss about mesh convergence, time step convergence and skyline storage scheme. What is the significance of isoparametric elements?

(b) Discuss briefly about generalized eigenvalue problem and standard eigenvalue problem.

Q2. For a four-node isoparametric quadrilateral element derive the strain-displacement matrix. The element is having two degrees of freedom per node and the shape functions in terms of natural coordinates ξ, η are expressed as $N_i = \{(1+\xi\,\xi_i)(1+\eta\,\eta_i)\}/4$.

Q3. For a nine-node quadrilateral element determine the shape functions using the product rule.

Q4. (a) Explain consistent mass matrix and lumped mass matrix.

(b) Discuss about the order of numerical integration in evaluating stiffness matrix.

Q5. What is meant by geometric stiffness matrix and cyclic symmetry in finite element analysis. Considering stress stiffening effect in buckling discuss the methods for determining the critical buckling load for a simply supported beam.