U.S.N.										

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

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: VII**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 21CV7OEFEA **Max Marks: 100**
Course: Finite Element Analysis

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) Derive equation of equilibrium for three dimensional stress state. **10**

b) Discuss with example plane stress and plane strain conditions. Derive stress strain relation for plane-stress condition. **10**

OR

2 a) A simply supported beam is subjected to a uniformly distributed load. Determine maximum deflection using Rayleigh Ritz method. **10**

b) Explain in detail the steps involved in the finite element analysis for solving a problem. **10**

UNIT - II

3 a) List the properties of stiffness matrix. **05**

b) With a neat sketch, derive stiffness matrix for a 1-D bar element. **10**

c) Define shape function. List the properties of shape functions. **05**

UNIT - III

4 Analyze the beam for member end forces as shown in Fig.1, by using FE technique. **20**

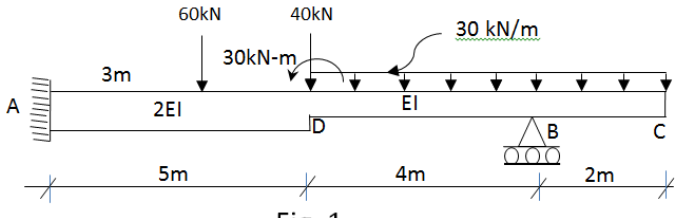

Fig. 1

UNIT - IV

5 a) Obtain expression for shape functions of CST element. Sketch their variations. **10**

b) Derive shape functions of a 9-noded 2D quadrilateral element using Lagrange polynomials. **10**

UNIT - V

6 a) Derive stiffness matrix for a 4-noded quadrilateral isoparametric element. **16**

b) Write the characteristics of a Jacobian matrix. **04**

OR

7 a) For the quadrilateral element shown in figure 2, find the Jacobian matrix at $\xi = ¼$ and $\eta = ¼$. **10**

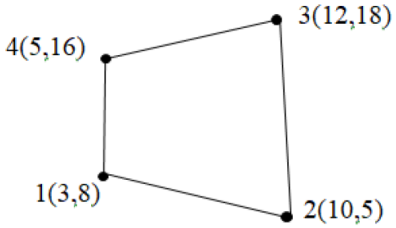

Fig. 2

b) A four-noded quadrilateral element has coordinates 1(10, 10), 2(50, 10), 3(60, 60) and 4(10, 40). If the element nodal displacement vector is given by $\{q\}=\{0, 0, 1, 2, 0, 1.5, 1, 0\}$ mm, determine (i) the x & y coordinates of point P which has $\xi = 0.5$ and $\eta = 0.5$ and (ii) displacements u & v of the point P. **10**

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