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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

First Semester, M. Tech - Civil Engineering (MCAD)

Make-up Examination; Feb - 2017

Computational Structural Mechanics

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Explain the importance of rotation transformation matrix. Write it for a plane truss element. 6

b. Compute the overall structure stiffness matrix and hence obtain the reduced structure stiffness matrix with reference to the d.o.f. given in Fig. Q1(b) for plane truss. 14

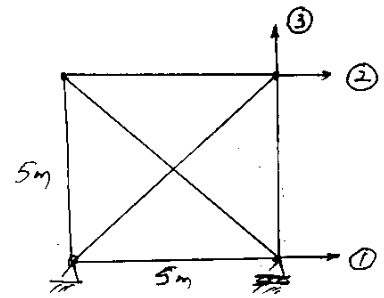

Fig. Q 1(b)

2. Analyse the pin jointed plane truss shown in Fig. Q(2) using direct stiffness matrix method. The areas of the member in mm^2 is shown on the members in parenthesis. 20

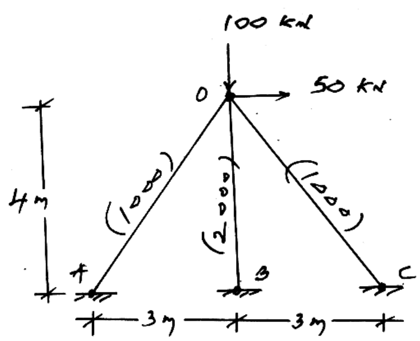

fig. Q(2)

UNIT - II

3. Analyse the continuous beam shown in Fig. Q(3) using direct stiffness method. Draw BMD, SFD and elastic curve. Take EI = constant. 20

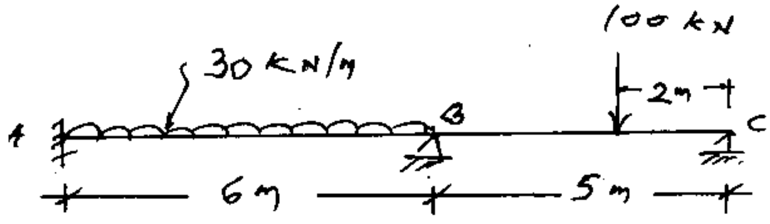

Fig. Q(3)

4. Analyse the rigid joint plane frame shown in Fig. Q(4) using direct stiffness matrix method. Draw BMD and elastic curve. 20

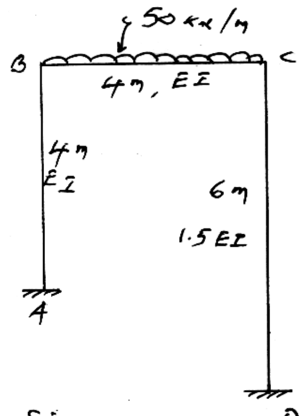

Fig. Q(4)

UNIT - III

5 a. Explain the terms: 10

i) Local co-ordinates ii) Natural co-ordinates

iii) Generalized co-ordinates iv) Degrees of freedom.

b. Explain with sketches various types of finite elements used for solving one, two and three dimensional problems. 10

6 a. Explain : 10

i) Principle of minimum Potential energy ii) Rayleigh Ritz method.

b. Using the variational principles of solid mechanics derive the equilibrium equation for a finite element. 10

UNIT - IV

7 a. What is a displacement model? Using displacement model for generalized coordinates explain the convergence requirements in FEM. 10

b. Derive the shape functions for first order rectangular element in natural co-ordinates 10

8. Derive the stiffness matrix of a CST element used for plane stress problems in natural co-ordinates. 20

UNIT - V

9 a. Derive the Hermitical shape functions for an axially rigid prismatic beam element in natural co-ordinates. 15

b. Obtain the consistent load vector for an isoparametric beam element 1-2 of length 5 m subjected to a concentrated load of 100 kN at 2 m from left node 1 in natural co-ordinates. 5

10 a. Derive the stiffness matrix for a beam element. 15

b. Explain consistent nodal load vector for a beam element. 5

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