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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)

Semester End Examination; Jan - 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 concepts of flexibility and stiffness methods of matrix analysis. 8

b. Discuss how to determine the static and kinematic indeterminacy of pin-jointed plane truss. 6

c. Explain : 6

i) Local axis ii) Global axes iii) Rotation transformation matrix.

2. Analyze the pin-jointed plane truss shown in Fig. Q2, by direct stiffness method. Take A = 100 mm^2 and E = 200 GPa for all members. 20

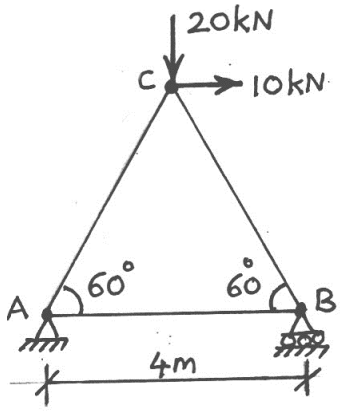

Fig.Q2

UNIT - II

3. Analyze the continuous beam shown in Fig. Q3, by direct stiffness method. Sketch neatly the BMD, and SFD. Assume EI = 48,000 kN-m^2. 20

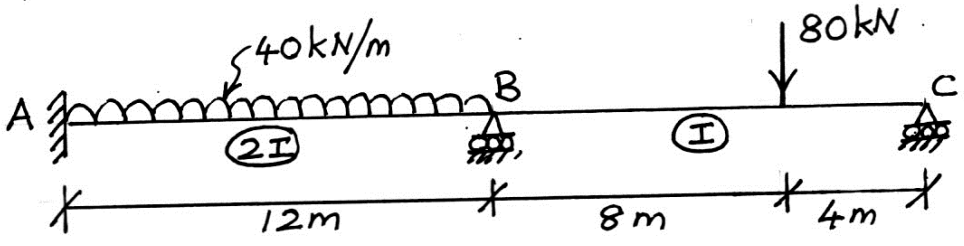

Fig.Q3

4. Analyze the rigid-jointed plane frame shown in Fig. Q4, by direct stiffness method. Sketch neatly the BMD. 20

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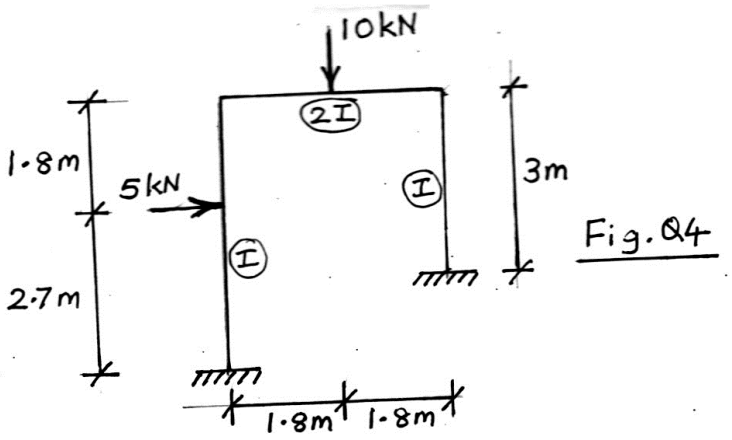

Fig. Q4

UNIT - III

5	a.	List the advantages of finite element method.	5
	b.	State and explain the principle of minimum potential energy.	5
	c.	Explain the important steps in finite element analysis.	10
6	a.	Discuss on 'the choice of displacement function' in finite element analysis.	6
	b.	Discuss the concept of weighted residual method.	8
	c.	What are natural coordinates? Explain its importance.	6

UNIT - IV

7	a.	Obtain the shape functions for a two-noded bar element using Lagrange interpolation formula. Also sketch neatly the shape functions.	5
	b.	Derive the expression of equivalent nodal body force vector for a three-noded bar element.	8
	c.	Derive the stiffness matrix for a two-noded bar element.	7
8	a.	What are isoparametric elements? Discuss with a suitable example.	5
	b.	A circular tapering bar carries loads as shown in Fig. Q8(b). It also carries a tractive force 6 kN/m. The weight density is 78 kN/m^3. Idealise the bar as two 2-noded bar elements. Find the stresses in the two elements. Take E = 200 GPa.	15

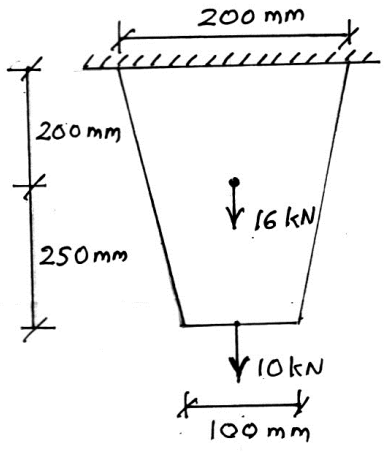

Fig. Q8(b)

Contd.....3

UNIT - V

9 a. Sketch neatly a beam element showing the DOFs. Write the stiffness matrix of the beam element (Do not derive). 4

b. Explain consistent nodal loads with an example. 4

c. Derive the shape functions for a two-noded beam element. Also plot neatly the variation of the shape functions. 12

10. Analyze the cantilever beam shown in Fig. Q10, by finite element analysis. Take EI = 40,000 kN-m^2. Sketch BMD, elastic curve and SFD. 20

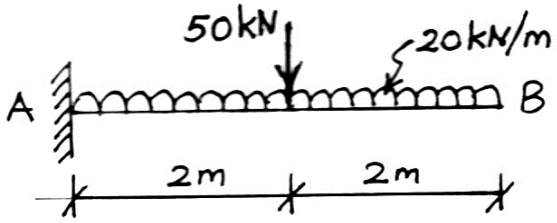

Fig. Q10

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