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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (New) EXAMINATION – WINTER 2019

Subject Code: 2160609 Date: 13/12/2019

Subject Name: Computational Mechanics

Time: 02:30 AM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Enlist various steps of finite element method.	**03**
	(b)	Write the steps in detail to analyze plane truss by using Stiffness member approach.	**04**
	(c)	Explain how following issues are handled in analysis (i) Sinking of support (ii) Presence of inclined support	**07**
Q.2	**(a)**	Determine [SMS]i for the grid shown in figure.1.	**03**
	(b)	Explain symmetry and anti-symmetry with suitable examples.	**04**
	(c)	Explain various types of non-linearity with neat sketches.	**07**
		OR	
	(c)	Derive member stiffness matrix of the frame member with usual notations.	**07**
Q.3	**(a)**	Formulate combined joint load vector for beam shown in figure 2	**03**
	(b)	Determine joint displacements for the beam shown in figure.2.	**04**
	(c)	Determine support reaction and draw SFD and BMD for the beam shown in figure.2.	**07**
		OR	
Q.3	**(a)**	Formulate combined joint load vector for the frame shown in figure 3	**03**
	(b)	Determine joint displacements for the frame shown in figure.3	**04**
	(c)	Determine support reaction and draw SFD and BMD for the frame shown in figure.3	**07**
Q.4	**(a)**	What is Finite Element Method, Explain in detail? Also discuss advantages and disadvantages.	**03**
	(b)	Explain meaning of convergence and convergence criteria in detail.	**04**
	(c)	Determine the joint displacements of the truss shown in figure-4 by member stiffness method. Assume that all members have the same axial rigidity AE=constant.	**07**
		OR	
Q.4	**(a)**	Derive shape functions for 2-noded bar element.	**03**
	(b)	Determine the shape functions for a Constant Strain Triangular (CST) element in cartesian coordinate systems.	**04**
	(c)	Explain : [SMS], [SRF], [RT], {AJ}, {AE}, {AFC}, {AR}	**07**
Q.5	**(a)**	For the plane stress CST element shown in figure-5, Determine the strain displacement matrix.	**03**
	(b)	For the plane stress CST element shown in figure-5, Determine the stiffness matrix.	**04**
	(c)	For the plane stress CST element shown in figure-5, Determine the load vector.	**07**
		OR	
Q.5	**(a)**	Using FEM, determine nodal displacements in elements for the Mild Steel bar assembly shown in the figure 6. consider E= 20000 N/mm^2.	**03**

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(b) Using FEM, determine stresses in elements for the Mild Steel bar assembly shown in the figure 6. consider E= 20000 N/mm^2. **04**

(c) Derive stiffness matrix for grid member using usual notations. **07**

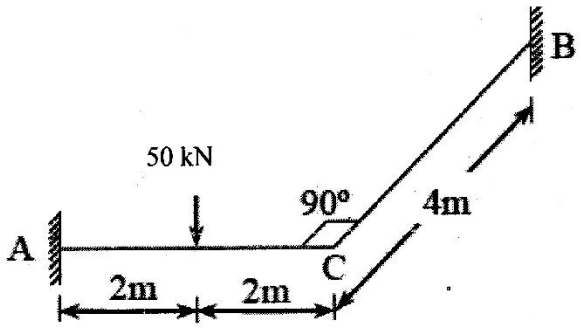

Figure 1

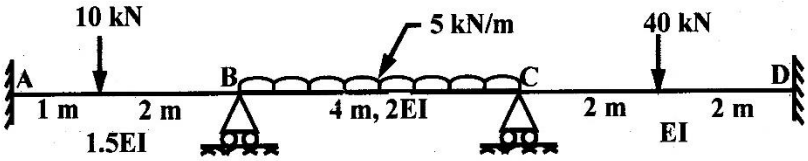

Figure 2

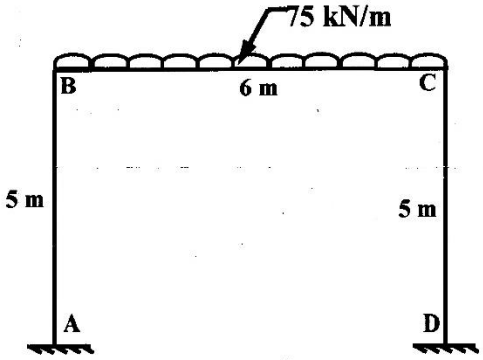

Figure 3

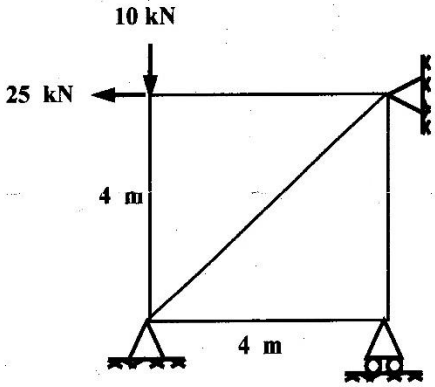

Figure 4

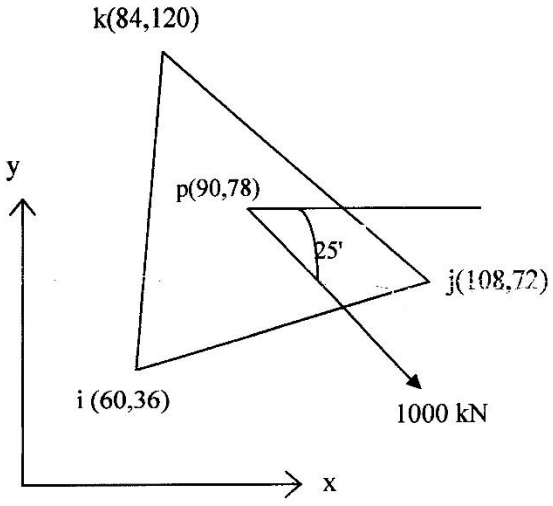

Figure 5

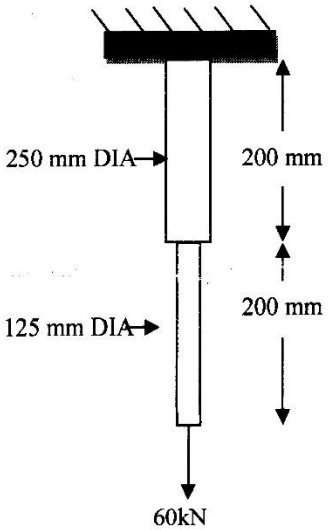

Figure 6

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