Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2018

Subject Code:2160609 **Date:07/12/2018**

Subject Name:Computational Mechanics

Time: 02:30 PM TO 05:30 PM **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	Explain symmetry and anti-symmetry with neat sketches.	**03**
	(b)	Derive S_M matrix for beam member.	**04**
	(c)	Determine joint displacements for the beam shown in fig.1. Take EI = constant.	**07**
Q.2	**(a)**	Formulate combined joint load vector for the grid shown in fig.2.	**03**
	(b)	Explain various types of skeleton structures with their internal forces and deformations.	**04**
	(c)	Formulate S_{MS} matrix for grid member.	**07**
		OR	
	(c)	Determine joint displacements for the loaded beam shown in fig.1, if the support B sinks by 10mm. Take EI = 30000 kNm^2.	**07**
Q.3	**(a)**	Determine joint displacements and member forces of the truss shown in fig.2. All the members have same axial rigidity. Take EA = constant.	**14**
		OR	
Q.3	**(a)**	Determine joint displacements and support reactions of the plane frame shown in fig.3. Take EI = 30000 kNm^2, EA = 2×10^6 kN.	**14**
Q.4	**(a)**	Write steps of finite element analysis.	**03**
	(b)	Explain plane stress and plane strain problems.	**04**
	(c)	Find nodal displacements and element stresses of the bar shown in fig.4. Take E = 200GPa.	**07**
		OR	
Q.4	**(a)**	Explain process of discretization.	**03**
	(b)	Using potential energy approach, derive the equation [k]{q}={f}.	**04**
	(c)	Find nodal displacements and nodal reactions for the beam shown in fig.5. Take EI = constant.	**07**
Q.5	**(a)**	Derive strain displacement matrix of CST element.	**07**
	(b)	Evaluate stiffness matrix of the CST element shown in fig.6. Assume plane stress condition and unit thickness of the element. Take E = 2×10^5 N/mm^2, $\mu = 0.3$.	**07**
		OR	
Q.5	**(a)**	Explain various types of non-linearity with neat sketches.	**07**
	(b)	For the plane stress element shown in fig.6, the nodal displacements are given as u1 = 0.05mm, v1 = 0.02mm, u2 = 0.0mm, v2 = 0.0mm, u3 = 0.04mm, v3 = 0.01mm. Determine the element stresses. Take E = 200GPa, $\upsilon = 0.3$, Use unit thickness for plane stress element.	**07**

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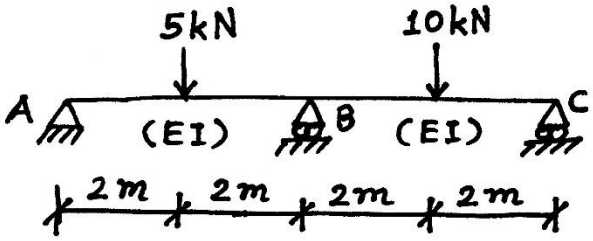

Fig. 1

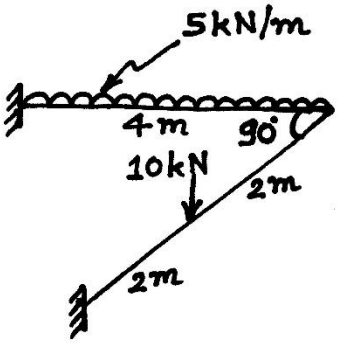

Fig. 2

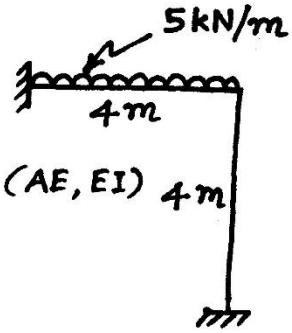

Fig. 3

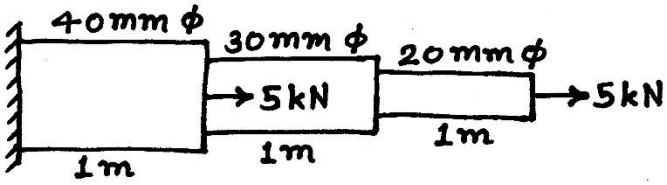

Fig. 4

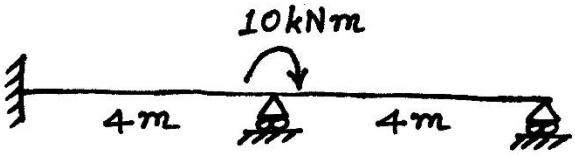

Fig. 5

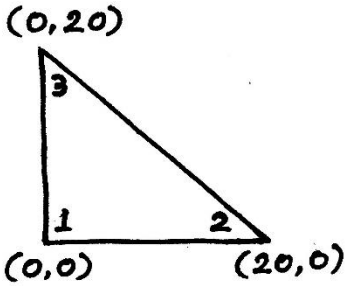

Fig. 6