

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2160609

Date:19/05/2016

Subject Name: Computational Mechanics

Time: 10:30 AM to 01:30 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 & clean sketches with pencil only.

- Q.1** (a) Determine the elements of the stiffness matrix for a grid member. 07  
(b) A bar shown in **fig.1.** has an axial load  $P = 100 \times 10^3$  N. Determine the 07  
1) Nodal displacement. 2) Stresses in each element. 3) Reaction forces.
- Q.2** (a) Analyse the plane truss shown in **fig.2.** and determine deflections and reactions 07  
at the joints. Use the concept of symmetry.  
(b) Analyse the frame for **fig.3.** by stiffness matrix method using member approach. 07  
Formulate rearranged SJ matrix only. Take  $AE = EI = \text{Constant}$ .
- OR**
- (b) Analyse the beam shown in **fig.4.** using stiffness member approach and plot SF 07  
& BM diagrams. Use the concept of symmetry.
- Q.3** (a) What is non linearity? Explain Geometrical, Material and Loading non linearity 07  
giving appropriate examples  
(b) Analyse the beam shown in **fig.5.** using stiffness member approach and plot SF 07  
& BM diagrams.
- OR**
- Q.3** (a) Enlist steps involved in FEM analysis and explain any two in detail. 07  
(b) Analyse the beam shown in **fig 6.** For following condition in addition to loading 07  
1) Joint 'B' is having elastic support of stiffness  $4EI/L$ .  
2) Joint 'C' is having rotational spring of stiffness  $EI/L$ . Take  $EI=2000\text{KN.m}^2$
- Q.4** Analyse the grid as shown in **fig.7.** Find out reactions & Draw B.M, S.F and 14  
Torsional moment diagrams. Use the concept of symmetry. Take  $GJ = 16 \times 10^3$   
 $\text{N.m}^2$ ,  $EI = 20 \times 10^3 \text{N.m}^2$ .
- OR**
- Q.4** Analyse the grid as shown in **fig.8.** Find out reactions & Draw B.M, S.F and 14  
Torsional moment diagrams. Take  $GJ=EI= \text{Constant}$ .
- Q.5** (a) Analyse the frame for **fig.9** by stiffness matrix method using member approach. 07  
Find Load Vector Only. Use the concept of symmetry.  
(b) Find the displacement of the composite structure shown in **fig.10.** Using 07  
stiffness member matrix C/S of beam is  $150\text{mm} \times 200\text{mm}$ .  $E_{\text{beam}} = 20000\text{N/mm}^2$
- OR**
- Q.5** (a) For the CST element Shown in **fig.11** below the nodal displacements are given 07  
as  $U_1=2 \text{ mm}$ ,  $U_2=0.5 \text{ mm}$ ,  $U_3= 3 \text{ mm}$   $V_1=1 \text{ mm}$ ,  $V_2= 0 \text{ mm}$ ,  
 $V_3= 1 \text{ mm}$ . Determine the Element Stresses  $\sigma_x$ ,  $\sigma_y$  and  $\tau_{xy}$ . Take  $E=200 \text{ Gpa}$   
Poisson's ratio=0.25  
(b) Derive the expression for the shape function of two noded & three noded Bar 07  
element taking natural coordinate  $\xi$  as varying from -1 to 1.

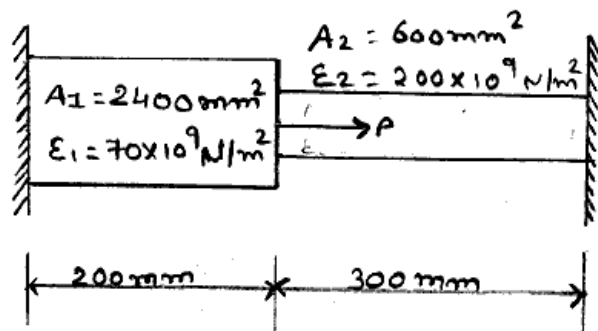


FIG-1

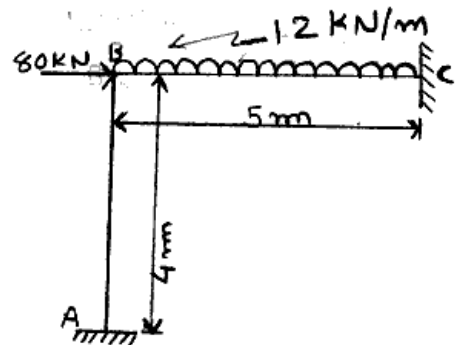


FIG-3

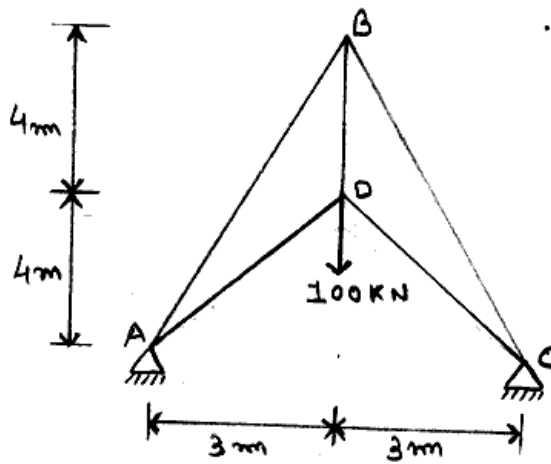


FIG-2

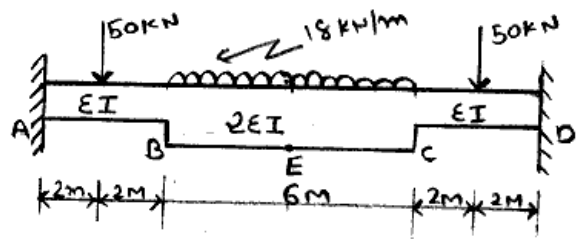


FIG-4

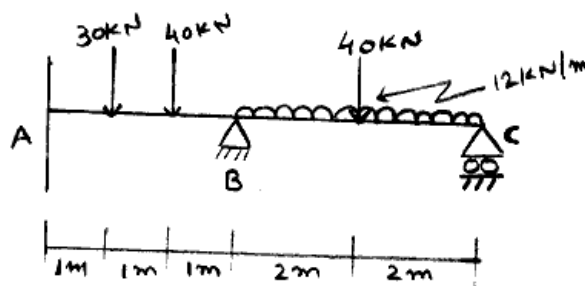


FIG-5

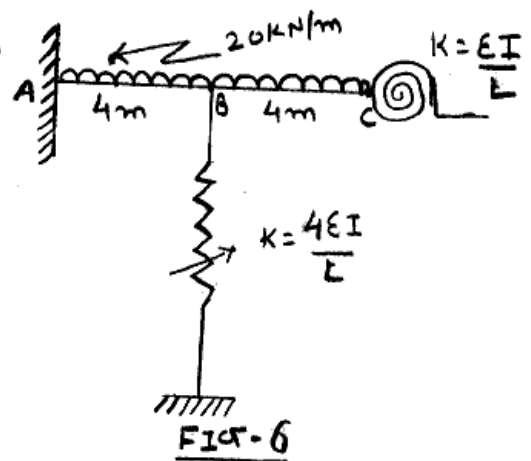


FIG-6

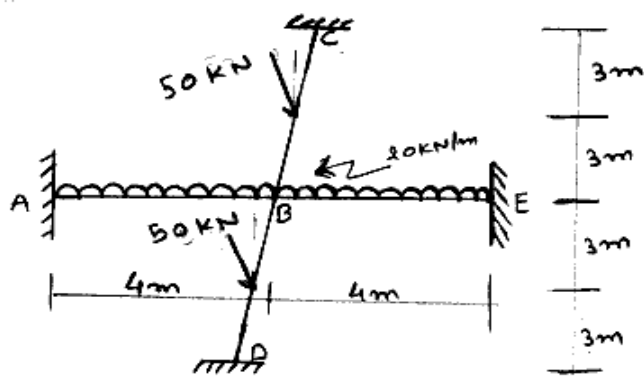


FIG-7

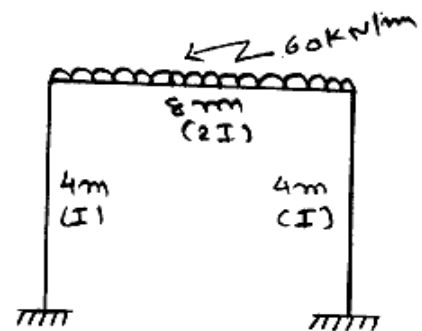


Fig-9

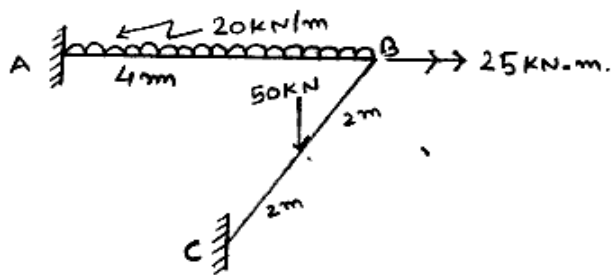


FIG-8

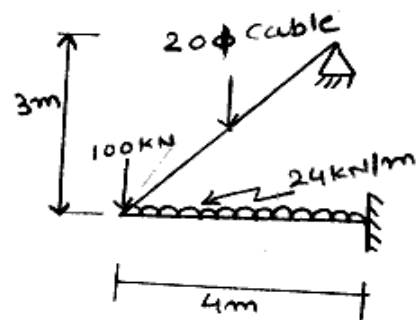


FIG-10

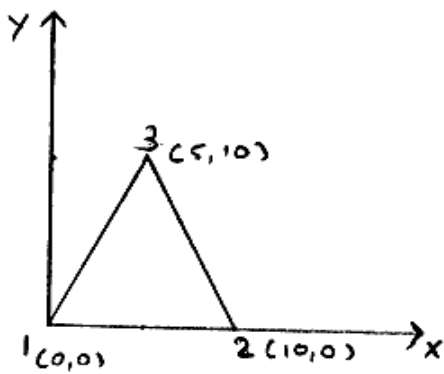


FIG-11