CE 6501 – STRUCTURAL ANALYSIS - I

QUESTION BANK

UNIT I - INDETERMINATE FRAMES

PART A

1. Why is it necessary to compute deflections in structures?

Computation of deflection of structures is necessary for the following reasons:

a. If the deflection of a structure is more than the permissible, the structure will not look aesthetic and will cause psychological upsetting of the occupants.

b. Excessive deflection may cause cracking in the materials attached to the structure. For example, if the deflection of a floor beam is excessive, the floor finishes and partition walls supported on the beam may get cracked and unserviceable.

2. What is meant by cambering technique in structures?

Cambering is techniques applied on site, in which a slight upward curve is made in the structure/ beam during construction, so that it will straighten out and attain the straight shape during loading. This will considerably reduce the downward deflection that may occur at later stages.

3. Name any four methods used for computation of deflections in structures.

1. Double integration method

2. Macaulay's method

3. Conjugate beam method

4. Moment area method

5. Method of elastic weights

6. Virtual work method- Dummy unit load method

7. Strain energy method

8. Williot Mohr diagram method

4. State the difference between strain energy method and unit load method in the determination of deflection of structures.

In strain energy method, an imaginary load P is applied at the point where the deflection is desired to be determined. P is equated to zero in the final step and the deflection is obtained. In unit load method, an unit load (instead of P) is applied at the point where the deflection is desired.

5. What are the assumptions made in the unit load method?

1. The external & internal forces are in equilibrium.

2. Supports are rigid and no movement is possible.

3. The materials is strained well within the elastic limit.

6. Distinguish between pin jointed and rigidly jointed structure.

Pin jointed structure Rigidly jointed structure

1. The joints permit change of angle between connected members.

The members connected at a rigid joint will maintain the angle between them even under deformation due to loads.

2. The joints are incapable of transferring any moment to the connected

Members and vice-versa. Members can transmit both forces and moments between themselves through the joint.

3. The pins transmit forces between connected member by developing shear. Provision of rigid joints normally increases the redundancy of the structures.

7. What is meant by thermal stresses?

Thermal stresses are stresses developed in a structure/member due to change in temperature. Normally, determine structures do not develop thermal stresses. They can absorb changes in lengths and consequent displacements without developing stresses.

8. What is meant by lack of fit in a truss?

One or more members in a pin jointed statically indeterminate frame may be a little shorter or longer than what is required. Such members will have to be forced in place during the assembling. These are called members having Lack of fit. Internal forces can develop in a redundant frame (without external loads) due to lack of fit.

9. Write down the two methods of determining displacements in pin jointed plane frames by the unit load concept.

The methods of using unit loads to compute displacements are,

i) dummy unit load method.

ii) using the principle of virtual work.

10. What is the effect of temperature on the members of a statically determinate plane truss.

In determinate structures temperature changes do not create any internal stresses. The changes in lengths of members may result in displacement of joints. But these would not result in internal stresses or changes in external reactions.

11. Distinguish between 'deck type' and 'through type' trusses.

A deck type is truss is one in which the road is at the top chord level of the trusses. We would not see the trusses when we ride on the road way. A through type truss is one in which the road is at the bottom chord level of the trusses. When we travel on the road way, we would see the web members of the trusses on our left and right. That gives us the impression that we are going` through' the bridge.

12. Define static indeterminacy of a structure.

If the conditions of statics i.e., $\Sigma H=0$, $\Sigma V=0$ and $\Sigma M=0$ alone are not sufficient to find

either external reactions or internal forces in a structure, the structure is called a statically indeterminate structure.

13. Differentiate the statically determinate structures and statically indeterminate structures?

Statically determinate structures statically indeterminate structures

1. Conditions of equilibrium are sufficient to analyze the structure Conditions of equilibrium are insufficient to analyze the structure

2. Bending moment and shear force is independent of material and cross sectional area. Bending moment and shear force is dependent of material and independent of cross sectional area.

3. No stresses are caused due to temperature change and lack of fit. Stresses are caused due to temperature change and lack of fit.

14. Define: Trussed Beam.

A beam strengthened by providing ties and struts is known as Trussed Beams.

15. Define: Unit load method.

The external load is removed and the unit load is applied at the point, where the deflection or rotation is to found.

16. Give the procedure for unit load method.

1. Find the forces P1, P2, ……. in all the members due to external loads.

2. Remove the external loads and apply the unit vertical point load at the joint if the vertical deflection is required and find the stress.

3. Apply the equation for vertical and horizontal deflection.

PART B

1. Determine the force in the members of the truss shown in figure. The cross sectional area of vertical and horizontal members is 4000mm2 and that of the diagonal is 6000 mm2.

al area of vertical and horizontal members is 4000 mm² and that of the m².

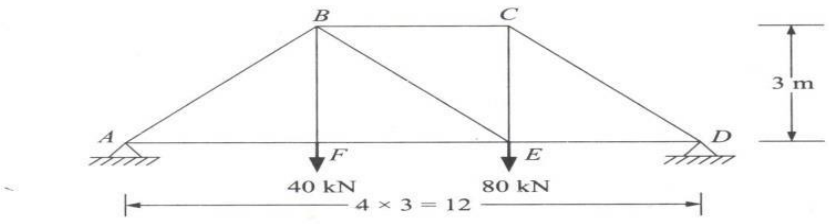
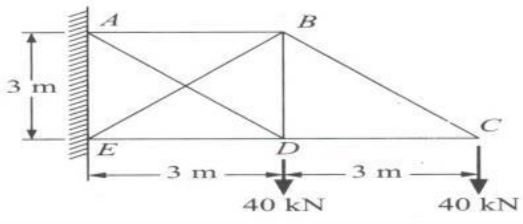


Figure 10.4(a) Example 10.1

2. Find the forces in the members of truss shown in figure. The cross sectional area and young's modulus of all the members are the same.



3. Find the forces developed in all the members of truss shown in fig, if the temperature of member AC goes up by 20°c. Take the co efficient of thermal expansion α=12X10-6/°c. Cross sectional area of all the members is 2500mm2 and young's modulus is 200KN/mm2.

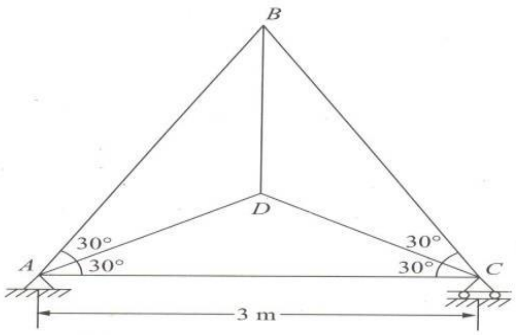
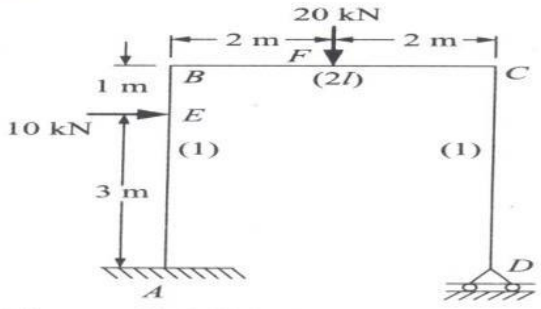


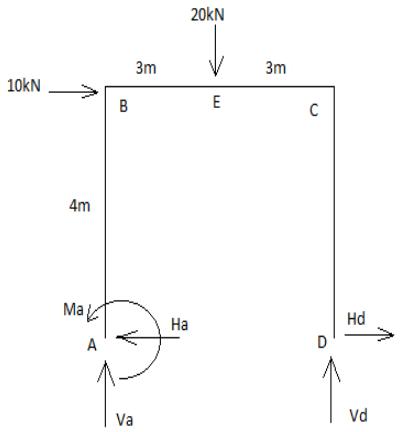
Figure 10.14(a) Example 10.7

4. In the frame ABCD shown in fig, end A is fixed and end D is on roller. Analyze the frame for the loading shown.

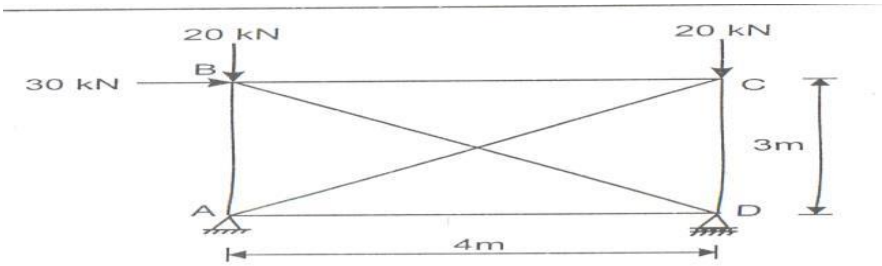
In the frame *ABCD* shown in Figure 11.20(*a*), end *A* is fixed a
ıe for the loadings shown.



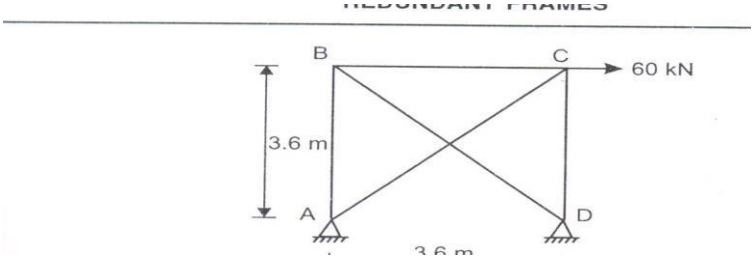
5. Analyses the frame shown in fig, using the consistent deformation method. Flexural rigidity is constant throughout.



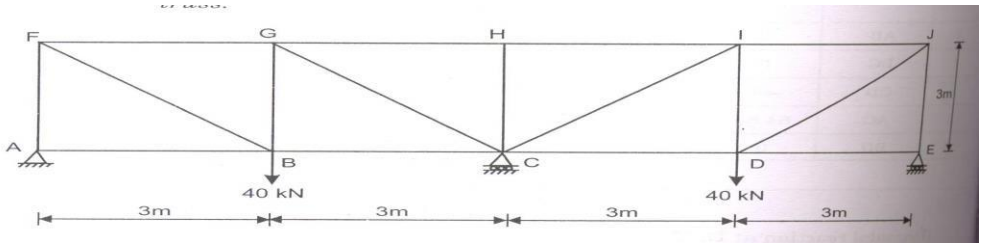
6. Find the stresses in all the members of the given frame, in which the cross sectional areas of vertical members are 3000mm2 each and those of all other members are 2200mm2. E=2x10^5 N/mm2.



7. Determine the forces in the members of the truss shown. AE is constant for all the members



8. A two span continuous truss is loaded as shown. All the members are of the same material and have the same cross sectional area. Find the reaction at the central support C. also fined the forces in all the members of the truss.



9. Find the forces in all the members of the pin-jointed frame work as show. All the members have the same area of cross section and Young's modulus.