Total number of printed pages–6

53 (CE 402) STAN–I

2021

STRUCTURAL ANALYSIS–I

Paper : CE 402

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. **1** *and* ***any four*** *from the rest.*

1. *(a)* Answer the following questions : 2×5=10

   (i) Write the basic tenets of structural analysis.

   (ii) How compound systems are analyzed ?

   (iii) What is internal and external indeterminacy ?

Contd.

(iv) What are linear and non-linear system ?

(v) What do you understand by statically indeterminate structure ?

(b) Fill in the blanks : 1×5=5

(i) The principle of virtual work can be applied to elastic system by considering the virtual work of _____ forces.

(ii) The Castigliano's second theorem can be used to compute _____ for any type of structure.

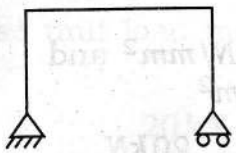
(iii) In slope deflection equation, the deformations are caused by _____.

(iv) The deflection at any point of a perfect frame can be obtained by applying a _____ load at the joint in the direction in which deflection is required.

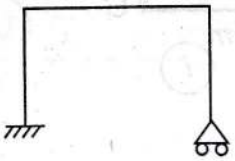
(v) The number of independent equations to be satisfied for static equilibrium of a space structure is _____.

(c) Calculate the degree of indeterminacy in the following frames : 1×5=5

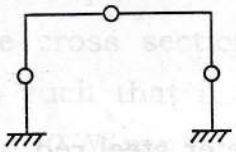
(i)



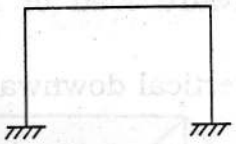
(ii)



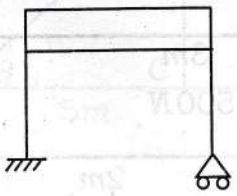
(iii)



(iv)

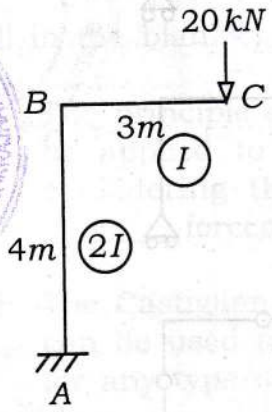


(v)



2. Determine the vertical and horizontal deflection at the free end of the beam shown in *Fig.* below : 20

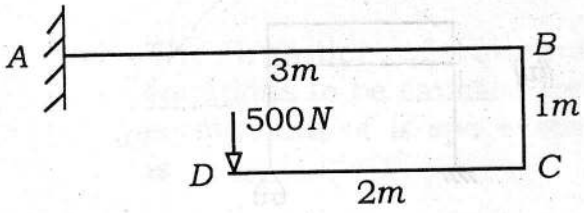
Given $E = 200\ kN/mm^2$ and $I = 30 \times 10^7\ N/mm^2$



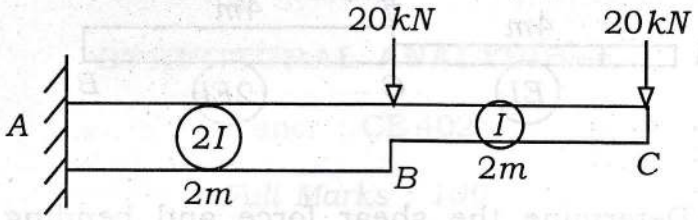
3. A 100 *mm* diameter steel rod is bent to the shape as shown below, and is subjected to a vertical downward load of 500*N* at the free end *D*.

Determine the vertical downward deflection of end *D*.

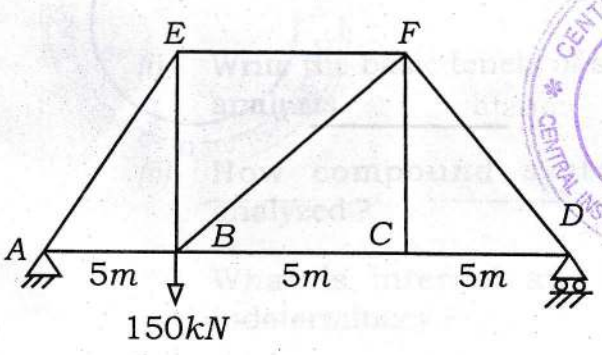
Take *EI* constant throughout. 20



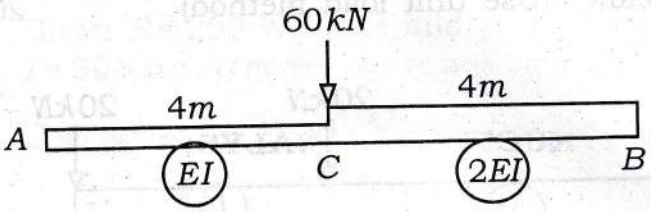
4. Determine the deflection and rotation at the free end of the cantilevers beam shown below : (Use unit load method) 20



5. A steel truss of span $15\,m$ is loaded as shown below. The cross sectional area of each number is such that it is subjected to a stress of $100\ N/mm^2$. Find the vertical deflection of the joint C.
Take $E = 200\ kN/mm^2$. 20



6. Determine the strain energy under 60 kN load and also determine the deflection at the same point. 20



7. Determine the shear force and bending moment of the beam shown below: 20