**53 (CE 402) STAN**

**2017**

# STRUCTURAL ANALYSIS-I

Paper : CE-402

*Full Marks : 100*

Time : Three hours

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

*Answer **any five** questions out of **seven**.*

1. A 100*mm* diameter steel rod is bent to the shape as shown in *Fig.*01 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 constant EI throughout. 20

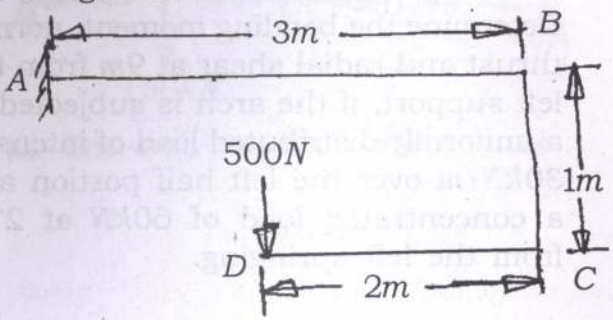


*Fig.*01

*Contd.*

2. A simply supported beam of span $12m$ is shown in *Fig.*02 is loaded as shown. Determine the vertical deflection at $D$ and rotation at $E$. Take $EI = 20000 kNm^2$. 20

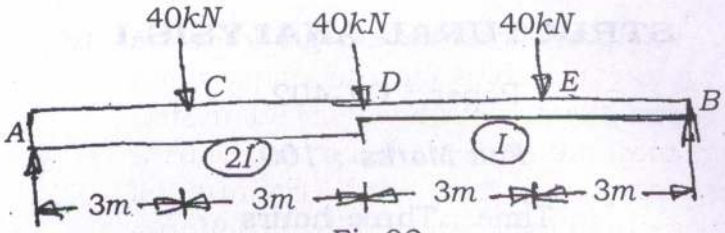


*Fig.*02

3. Discuss the following : 4×5

   *(a)* Difference between determinate and indeterminate structures.

   *(b)* Moment area theorems.

   *(c)* Strain Energy method.

   *(d)* Conjugate beam method & theorems.

4. *(a)* A three hinged symmetric circular arch has a span of $36m$ and a rise of $6m$. Determine the bending moment, normal thrust and radial shear at $9m$ from the left support, if the arch is subjected to a uniformly distributed load of intensity $30 kN/m$ over the left half portion and a concentrated load of $60kN$ at $27m$ from the left springing. 16

(b) What is the benefit of a arch over a beam ? When arches are prefered over beams ? 2+2

5. A steel truss of span $15m$ is loaded as shown in *Fig.* 03. The cross sectional area of each member 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

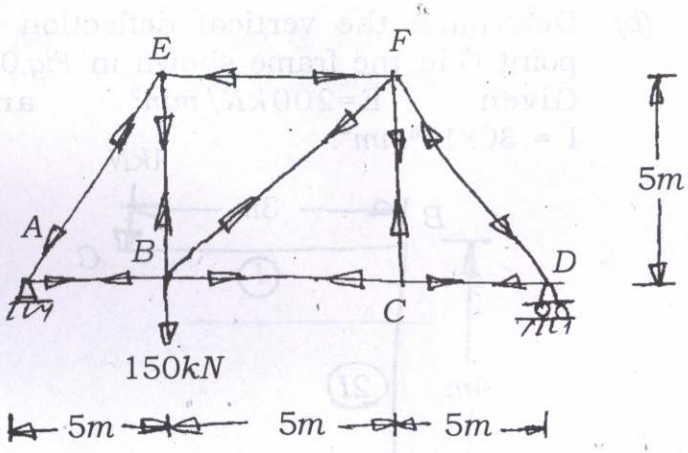


*Fig.*03

6. *(a)* Using conjugate beam method determine the deflection and rotation at the free end in the beam as shown in *Fig.* 04. 12

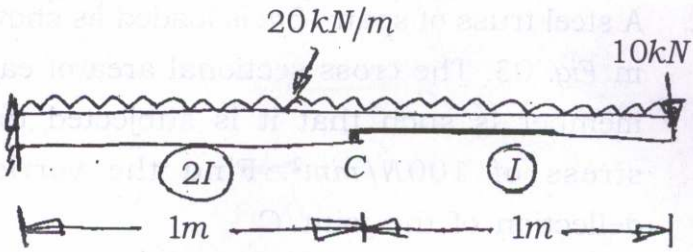


*Fig.* 04

*(b)* Determine the vertical deflection of point *C* in the frame shown in *Fig.*05. Given $E=200\,kN/mm^2$ and $I = 30\times10^6 mm^4$. 8

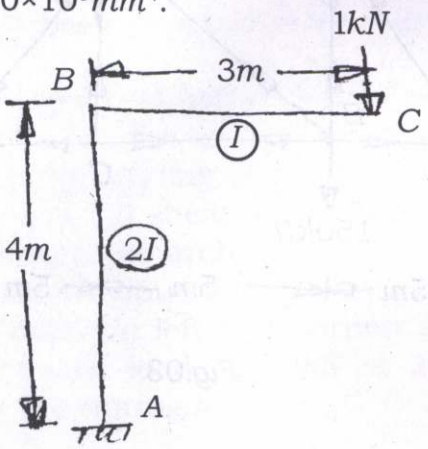


*Fig.*05

7. *(a)* For cable subjected to a uniformly distributed load derive that, length of the Cable (L), is given by $L = l + \frac{8h^2}{3l}$. 10.

*(b)* For cables with ends at different levels, derive that, horizontal reactions at supports is given by

$$H = \frac{wl^2}{2\left(\sqrt{h_1} + \sqrt{h_2}\right)^2}$$ 10

***Note :*** For 7*(a)* & 7*(b)* different symbols have their usual meanings.