

# DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

## MINOR II :CEL717 ADVANCED STRUCTURAL ANALYSIS (2014-15)

Time allowed: 1 hour

Date: 08 Oct 2014

Venue: IV LT 1

Max marks : 20

NOTE: (a) All questions are compulsory. (b) Draw neat and clear sketches wherever required.  
(c) Assume suitable data if necessary. (d) Assume members as extensible unless otherwise stated.  
(e) All answers must be supported by calculations/ justification to secure assigned marks.

- Q1. (a) Explain how plastic hinge is formed in a determinate structure. Identify the major intermediate major stages.  
(b) Determine the shape factor for the T section shown in Figure 1. Determine also  $M_y$  and  $M_p$ , assuming a yield stress of 400 MPa.  
(2x 2.5 = 5 marks)
- Q2. For the structure shown in Figure 2, use symmetry to formulate the matrix equations (consisting of the force matrix, including reactions, and the stiffness matrix).  
(5 marks)
- Q3. (a) Determine the term  $K_{22}$  of the stiffness matrix for a non prismatic plane frame member assuming that the moment of inertia linearly varies from "I" at the right end to "I" at the left end. The numbering of the degrees of freedom shall be as for normal 2D plane frame structures.  
(b) For the above structure, determine also the fixed ended moments for a point load acting at the centre of the beam.  
(5+2.5= 7.5 marks)
- Q4. Explain with examples the relevance of the method of substructures in matrix stiffness approach.  
(2.5 marks)

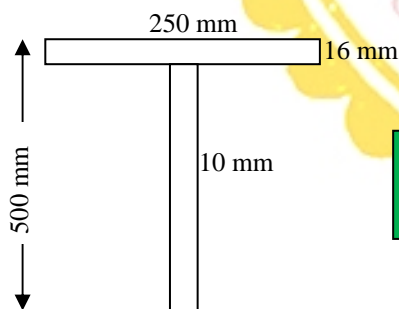


Fig. 1

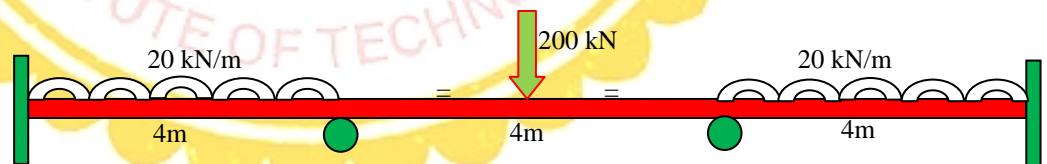


Fig. 2