

DEPARTMENT OF CIVIL ENGINEERING: IIT DELHI
SEMESTER I : 2007-08
CEL 718: DESIGN OF STEEL STRUCTURES
MAJOR TEST

Max. Marks=45

All questions compulsory
Use of IS: 800- 2007 is allowed

Time allowed=2 hrs

- I. A steel column in an industrial structure is subjected to an axial force, biaxial bending moments and the corresponding shear forces due to self weight and live loads. Using relevant Code, check the safety of the column.
Relevant data: Yield strength of steel = 400 MPa
Effective length in both directions = 8m
Characteristic values of the internal forces:
Axial compressive force = 1000 kN
Bending moments about x-x and y-y axes vary linearly.
- | | | |
|--------|---------------------------|----------------------------|
| Top | $M_x = 1000 \text{ kN-m}$ | $M_y = -1200 \text{ kN-m}$ |
| Bottom | $M_x = -800 \text{ kN-m}$ | $M_y = -200 \text{ kN-m}$ |

(20)

- II. An unprotected steel beam is exposed to a temperature of 400 degree C due to fire from three sides. From its exposed surface area to mass ratio, the value of the coefficient K_{sm} has been determined as 3. The yield strength and the maximum allowable stress of steel respectively are 450 MPa and 100 MPa. Check whether or not the structure satisfies the requirement of Fire Resistant Level (FRL) of half an hour.

(10)

- III A built-up 8m long simply supported steel beam is subjected to a concentrated live load acting at the mid span in addition to its self-weight. The characteristic values (at 95% confidence level) of the material yield strength f_y , dead load (L_D) and live loads (L_L) are given as 400MPa, 50 kN/m and 1000 kN. The corresponding values of the standard deviation are 20MPa, 5kN/m and 50 kN respectively. The flanges and the web of the beam I- section are made by using 600mm wide and 28mm thick plates.

Determine the Reliability Index of the beam against flexural collapse at mid-span. The beam can be assumed to possess sufficient resistance against buckling.

(10)

- IV State the Codal method for determining the Elastic Buckling Load Factor for in-plane buckling of regular sway frames.

(5)

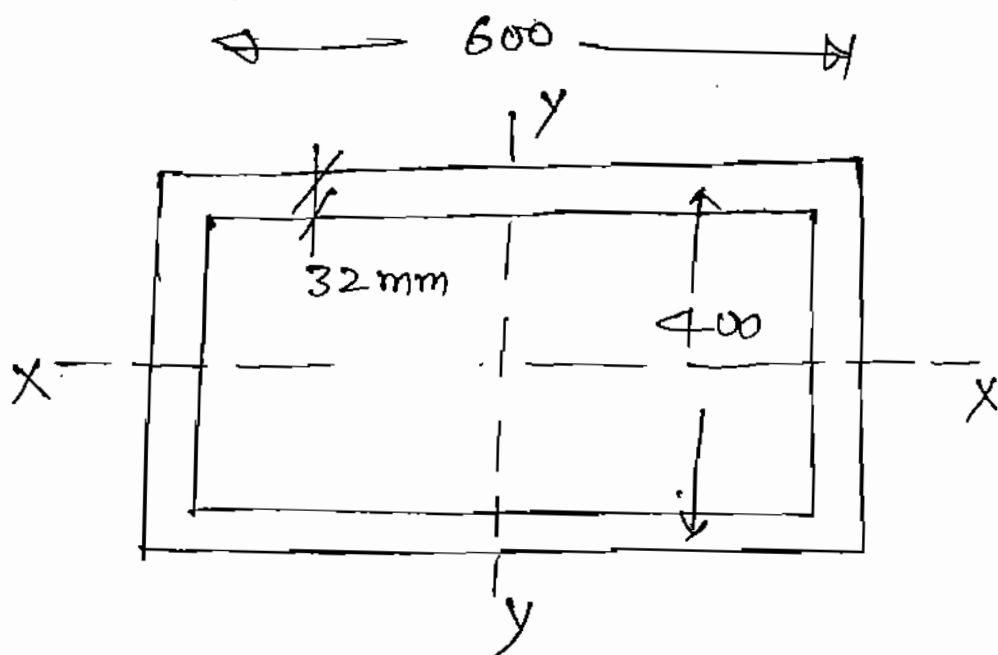


FIG. 1. COLUMN SECTION