IAT 2- 10CV72 SOLUTIONS

1. WHAT ARE THE ADVANTAGES AND DISADVANTAGES OF WELDING JOINTS?

ADVANTAGES OF WELDING JOINTS

1. As no hole is required for welding, hence no reduction of area. So structural members are more effective in taking the load.
2. In welding filler plates, gusseted plates, connecting angles etc, are not used, which leads to reduced overall weight of the structure.
3. Welded joints are more economical as less labor and less material is required.
4. The efficiency of welded joint is more than that of the riveted joint.
5. The welded joints look better than the bulky riveted/butted joints.
6. The speed of fabrication is faster in comparison with the riveted joints.
7. Complete rigid joints can be provided with welding process.
8. The alternation and addition to the existing structure is easy.
9. No noise is produced during the welding process as in the case of riveting.
10. The welding process requires less work space in comparison to riveting.
11. Any space of joint can be made with ease.

DISADVANTAGES OF WELDING JOINTS

1. Welded joints are more brittle and therefore their fatigue strength is less than the members joined.
2. Due to uneven heating & cooling of the members during the welding, the members may distort resulting in additional stresses.
3. Skilled labor and electricity are required for welding.
4. No provision for expansion and contraction is kept in welded connection & therefore, there is possibility of racks.
5. The inspection of welding work is more difficult and costlier than the riveting work.
6. Defects like internal air pocket, slag inclusion and incomplete penetration are difficult to detect.

(2) Design an angle strut using double angle to carry a load 300 kN use welded connection take length of the member 2m.

Soln:- Given, load = 300 kN.

factored load = $1.5 \times 300 = 450$ kN

Assume $f_{cd} = 100$ N/mm²

Area required = $\frac{\text{factored load}}{f_{cd}} = \frac{450 \times 10^3}{100}$

$= 4500$ mm²

from steel table, Table 7, Page 24

ISA 12595 or 125×95×12

Area = 4996 mm²

$r_{xx} = 3.91$ cm $= 39.1$ mm

choose 10mm plate

$r_{yy} = 4.05$ cm $= 40.5$ mm

$r_{min} = 39.1$ mm

effective length for a welded connection

$l_e = 0.7 \times L$

$= 0.7 \times 2000$

$l_e = 1400$ mm

(for bolted, 0.85L
for welded, 0.70L

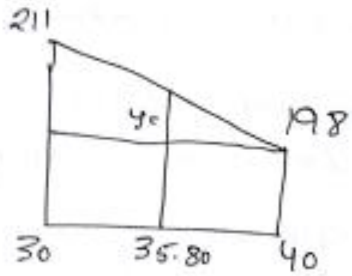
Slenderness ratio,

$$\lambda = \frac{l_e}{r_{min}} = \frac{1400}{39.1} = 35.8$$

from IS 800, page 44, Table 10,

Buckling class 'C'.

from table 9 (c), table page 42



$$\frac{211-198}{40-30} = \frac{y}{40-35.8}$$

$y = 5.46$.

$\therefore 198 + 5.46$

$f_{cd} = 203.46$

Design compressive strength $= A \times f_{cd}$

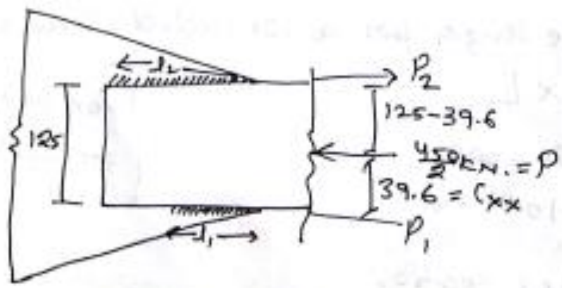
$= 4996 \times 203.46$

$= 1016.486$ kN.

> 450 kN.

$\therefore$ Safe

Design of welded connection,



C_{xx} = 39.6
from steel table

Size of the weld = $\frac{3}{4}$ × Angle thickness

$S_1 = \frac{3}{4} \times 12 =$ ~~0.0625~~ 9

Strength of the weld @ lower edge

$P_1 =$ ~~0.7×t~~ $\times \frac{f_u}{\sqrt{3}\,\gamma_{mw}} \times l_1 \times (S \times 0.7)$ — ①

Strength of the weld @ upper edge

$P_2 =$ ~~0.7×t~~ $\times \frac{f_u}{\sqrt{3}\,\gamma_{mo}} \times l_2 \times (S \times 0.7)$ — ②

$P = \frac{450}{2} = P_1 + P_2$

Taking moment about l_1,

Taking moment about l_1,

$$P_2 \times 125 = \frac{450}{2} \times ~~39.6~~ \times 39.6$$

$$P_2 = 71.28 \text{ kN}$$

from eqn ②

$$71.28 \times 10^3 = (~~0.0625~~\ 9 \times 0.7) \times \frac{410}{\sqrt{3} \times 1.25} \times l_2$$

$$\underline{l_2 = 59.74 \text{ mm}}$$

$$P_1 + P_2 = P$$

$$P_1 = \frac{450}{2} - 71.28$$

$$P_1 = 153.72.$$

$$153.72 \times 10^3 = 0.7 \times 9 \times \frac{410}{\sqrt{3} \times 1.25} \times l_1$$

$$\underline{l_1 = 128.84 \text{ mm}}$$

* Design a compression member using double channel section back to back carrying a factored load of 1800 kN the length of the column is 6m one end fixed other hinged also design suitable lacing system

Soln factored load = 1800 kN

Assume f_{cd} = 180 N/mm2

Area required = $\frac{1800 \times 10^3}{180} = 10000$ mm²

for single angle = 5000 mm²

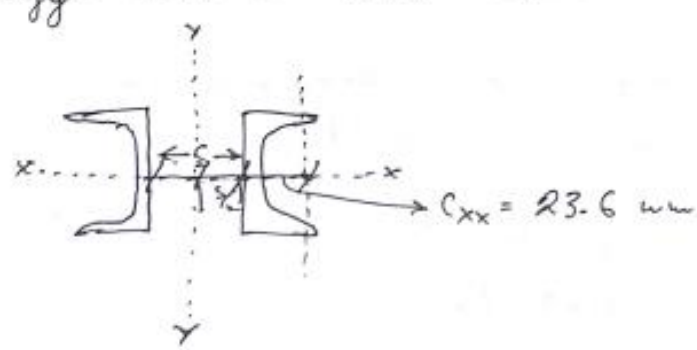
from steel table, Tables, page No 16,

ISL 400

$I_{xx} = 13989.5 \times 10^4$ mm⁴.

* $I_{yy} = 460.4 \times 10^4$ mm⁴

C_{yy} = 2.36 cm = 23.6 mm., A = 5825 mm²



Spacing should be such that $I_{xx} = I_{yy}$

$$I_{xx} = 2\left[13989.5\right] \times 10^4$$

$$= 279.79 \times 10^6 \ mm^4$$

$$I_{yy} = 2\left[460.4 \times 10^4 + \left(5825 \times \left(\frac{s}{2} + c_{xx}\right)^2\right)\right]$$

$$279.79 \times 10^6 = 2\left[460.4 \times 10^4 + \left\{5825 \times \left(\frac{s}{2} + 23.6\right)^2\right\}\right]$$

$$s = 257.6 \ mm$$

$$I_{min} = 279.79 \times 10^6 \ mm^4$$

$$r_{min} = \sqrt{\frac{I_{min}}{A}} = \sqrt{\frac{279.79 \times 10^6}{2 \times 5825}}$$

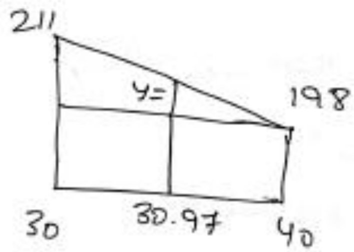
$$r_{min} = 154.97$$

from IS800, Page 45, Table 11.

$$l_{eff} = 0.8 L$$

$$\lambda = \frac{l_{eff}}{r_{min}} = \frac{0.8 \times 6000}{154.97} = 30.97.$$

Buckling class 'c',
from table 9'c',



$$\frac{211-198}{40-30} = \frac{y}{40-30.97}$$

$y = 11.739$

$\therefore f_{cd} = 198 + 11.739$

$f_{cd} = 209.739$.

Design compressive strength, $= A \times f_{cd}$

$= 209.739 \times 2 \times 5825$

$= 2443.4$ kN.

> 1800 kN.

$\therefore$ Safe