Eg :- 5.9

Design the purlin for the following specifications:

Span of the truss = 12m c/c

Pitch = $\frac{1}{5}$ of span

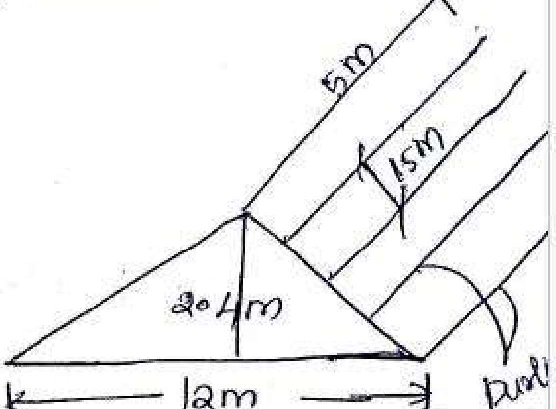
Spacing of truss = 5m c/c

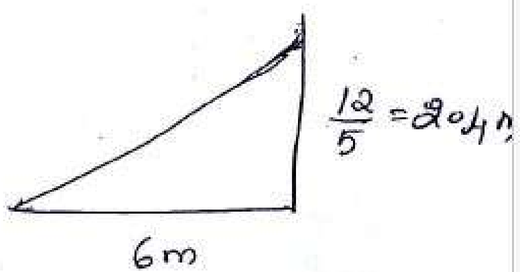
Spacing of purlins = 1.5 m c/c

Load from roofing material = 200 N/m^2

Wind load = 1200 N/m^2

use angle section:





Solution:

Assume the load = 600 N/m^2.

pitch = $\frac{1}{5}$.

$\frac{1}{5} = \frac{\text{Rise}}{\text{Span}}$

Rise = $\frac{1}{5}$ × span

= 2.4m.

$\tan(\theta) = \frac{2.4}{6}$

$\theta = 21.8°$

$$\text{min. depth} = \frac{L}{45} = \frac{5000}{45} = 111\ mm$$

$$\text{min } \sout{\text{depth}}\ \text{width} = \frac{L}{60} = \frac{5000}{60} = 83\ mm$$

using min. depth and width values find the section using steel table:

Pg: 18. ISA 125 × 95 × 8 mm.

dead load. $= 200\ N/m^2$

dead load / m $= 200 \times 1.5$

$= 300\ N/m$

Live load / m $= 600\ N/m^2$

$= 600 \times 1.5$

$= 900\ N/m$

∴ total vertical load / m $= 300 + 900 = 1200\ N$

∴ factored [dead load + Live load] along the sheeting

$= [300 + 900] \times 1.5 \times \cos 21.8$

$= 1671.27\ N/m$.

factored [dead load + wind load] normal to the sheeting.

$= [800 + 1800] \times 1.5 \times \sin 21.8$ ~~cos~~

$=$ ~~2924.7 N/m~~ $1169\ N/m$.

B.M

maximum B.M = $\frac{wl^2}{10}$ (or) $\frac{wL}{10}$ for purlin.

$= \frac{1671 \times (5)^2}{10}$ (1671 → max. value)

max. B.M. = 4177.5 N/m

from steel table: for ISA 125 x 95 x 8 mm

$r_1 = 9$ mm

$b/t \Rightarrow b = \frac{b1}{2} = \frac{47.5}{8} = 5.9375\varepsilon$

$d/t = \frac{125}{8} = 15.7 < 15.7\varepsilon$

∴ The section is semicompact section.

Moment for semicompact section

$M_d = \frac{Z_p f_y}{\gamma_{m0}} \times \beta_p$

$\beta_b = \frac{Z_e}{Z_p}$

$M_d = \frac{Z_p \times f_y \times \frac{Z_e}{Z_p}}{\gamma_{m0}}$

$Z_e = 30.6$ [from pg: 19 steel table]

$M_d = \frac{250 \times 30.6 \times 10^3}{1.10}$

M_d (design) $= 6.954545 \times 10^6$ N/mm

hence safe M_d (design) > M_d provided