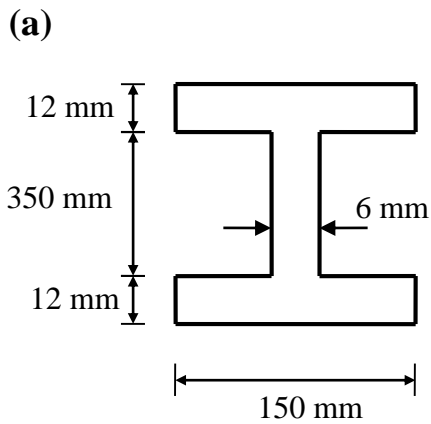


CE388 - FUNDAMENTALS OF STEEL DESIGN

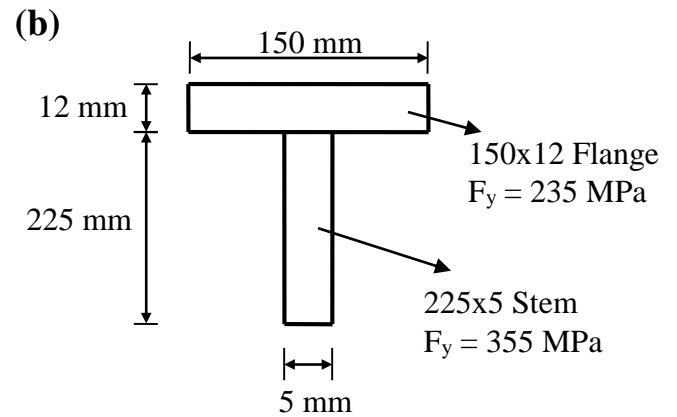
2014-2015 Spring Term

Problem Set 3

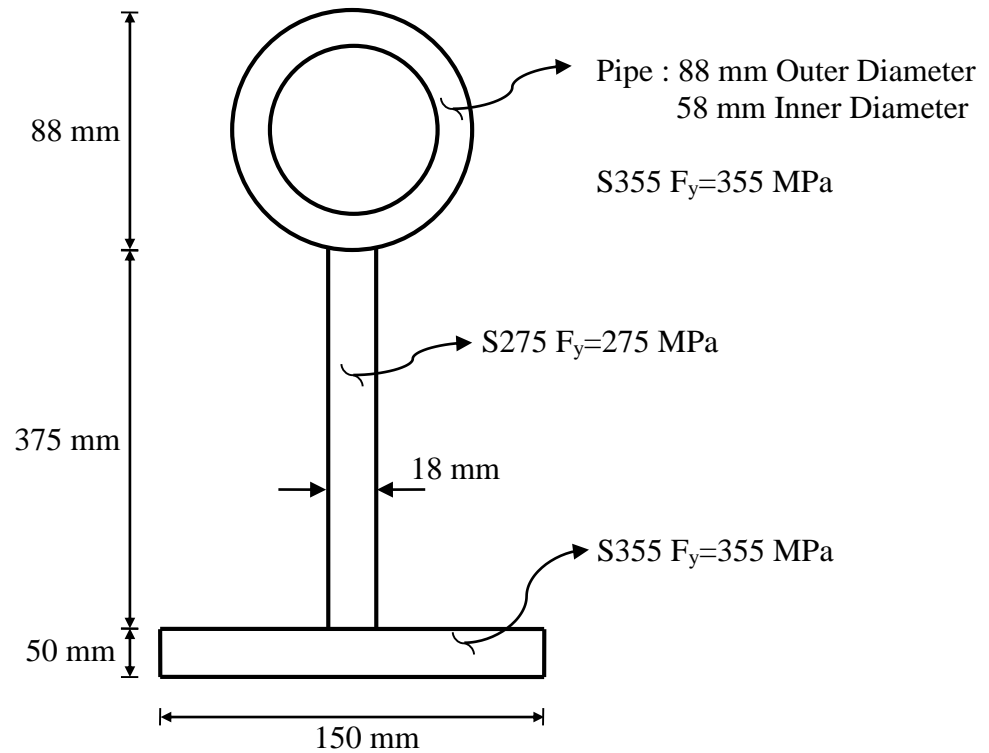
1) Compute M_p for strong axis bending for each of the following cross - sections.



$F_y = 235 \text{ MPa}$

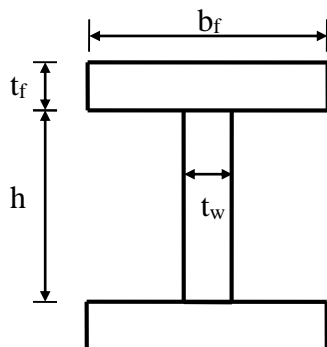


2) For strong axis bending, compute M_y and M_p .



3) For all cases consider S275 Steel.

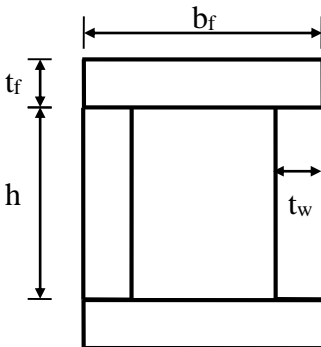
a) For the following built up I-shape cross-sections under strong axis bending, determine cross-section classification (i.e. compact, non-compact slender).



Case	i	ii	iii	iv
h (mm)	1000	1000	600	600
t_w (mm)	10	5	10	10
b_f (mm)	300	300	500	500
t_f (mm)	20	20	10	15

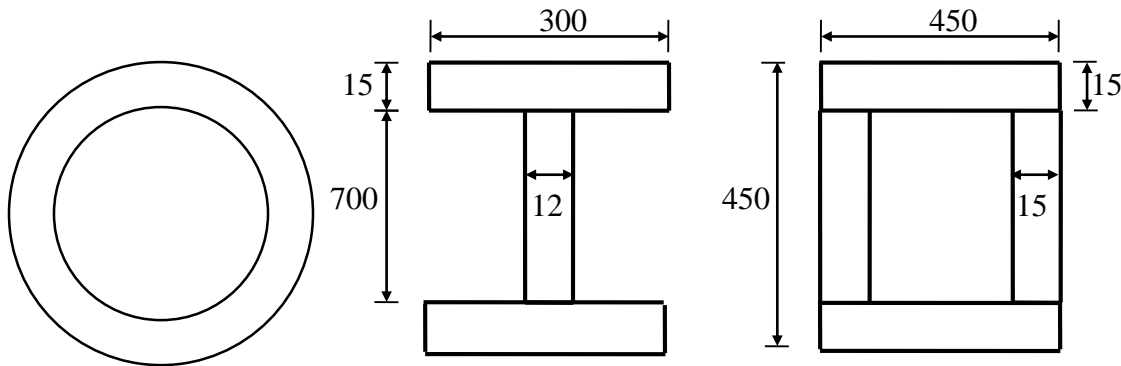
b) Repeat the same problem for weak axis bending.

c) Classify the following built up box shape cross-sections under strong axis bending.



Case	i	ii	iii	iv
h (mm)	1000	1000	600	600
t _w (mm)	10	5	10	10
b _f (mm)	300	300	500	500
t _f (mm)	20	20	10	15

d) Classify the following sections under axial compression (i.e. nonslender and slender).



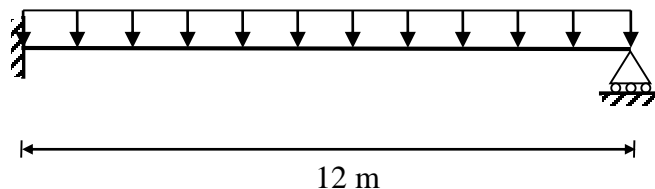
Outer Diameter = 800
Wall Thickness = 8

Units are mm

4) Find lightest I-shape of S355 Steel ($F_y=355$ MPa). (Consider IPN, IPE, HEA, HEB, and HEM Sections) (W_D is dead load and W_L is live load) Consider LRFD and ASD separately.

Service Loads : $W_L = 60$ kN/m

$W_D = 30$ kN/m (includes beam self weight)

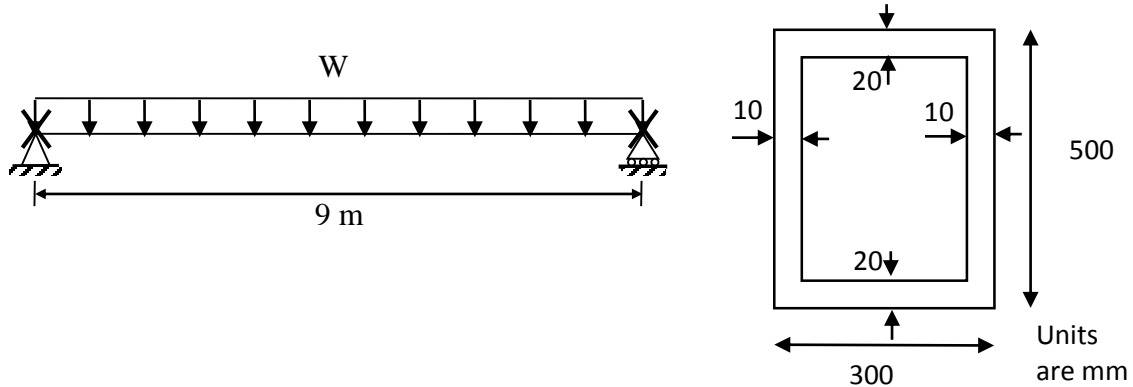


Beam is provided with adequate lateral support so that lateral torsional buckling does not control.

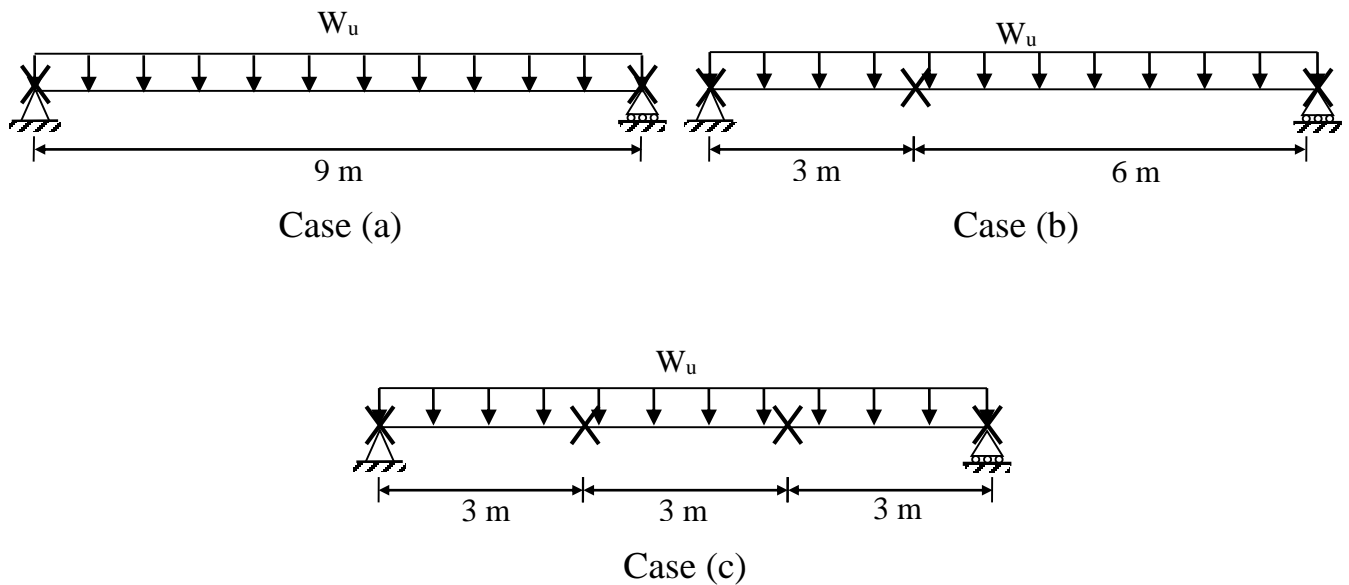
Serviceability Requirement : Service live load deflection $\leq \frac{L}{360}$

- 5) For the beam shown below, determine the maximum value of unfactored distributed load W . Lateral supports are at the ends only.

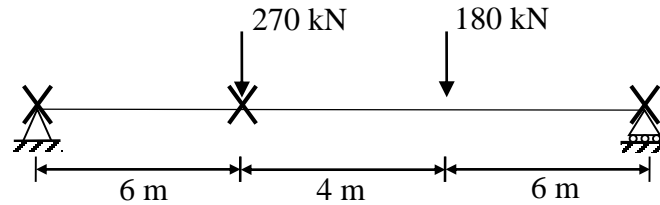
S275 Steel ($F_y = 275 \text{ MPa}$). Use ASD. Do not check deflections.



- 6) Beam IPN500 S275 Steel ($F_y = 275 \text{ MPa}$). Lateral supports at places marked by (X) only. Find the maximum uniform factored load, W_u , that the beam can safely support for the following three cases. Assume W_u includes beam self-weight. Assume shear and deflections are OK.



- 7) The simply supported beam shown below carries factored loads of 270 kN and 180 kN. Lateral supports are provided at the ends and under the 270 kN load. (No support at 180 kN load.) Choose the lightest I-Shape of S275 Steel ($F_y=275$ MPa). Neglect beam self-weight. Assume shear and deflections are OK. (Consider IPN, IPE, HEA, HEB, and HEM Sections)



- 8) Plot a graph showing M_n vs. L_b (unbraced length) for a IPN200 beam of S275 Steel ($F_y=275$ MPa). Show L_b from 0 to 7.5 m. Plot lines for $C_b = 1$ and $C_b = 1.75$.