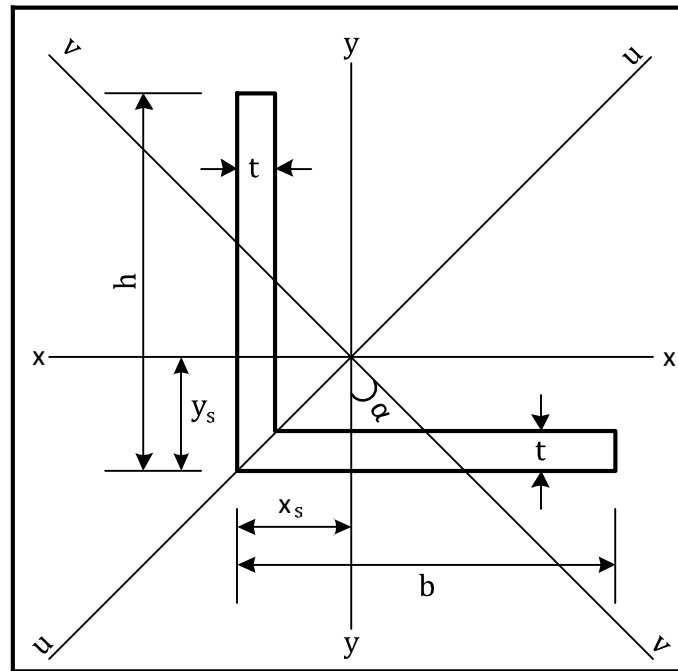


# CE388 - FUNDAMENTALS OF STEEL DESIGN

2014-2015 Spring Term

## Problem Set 1

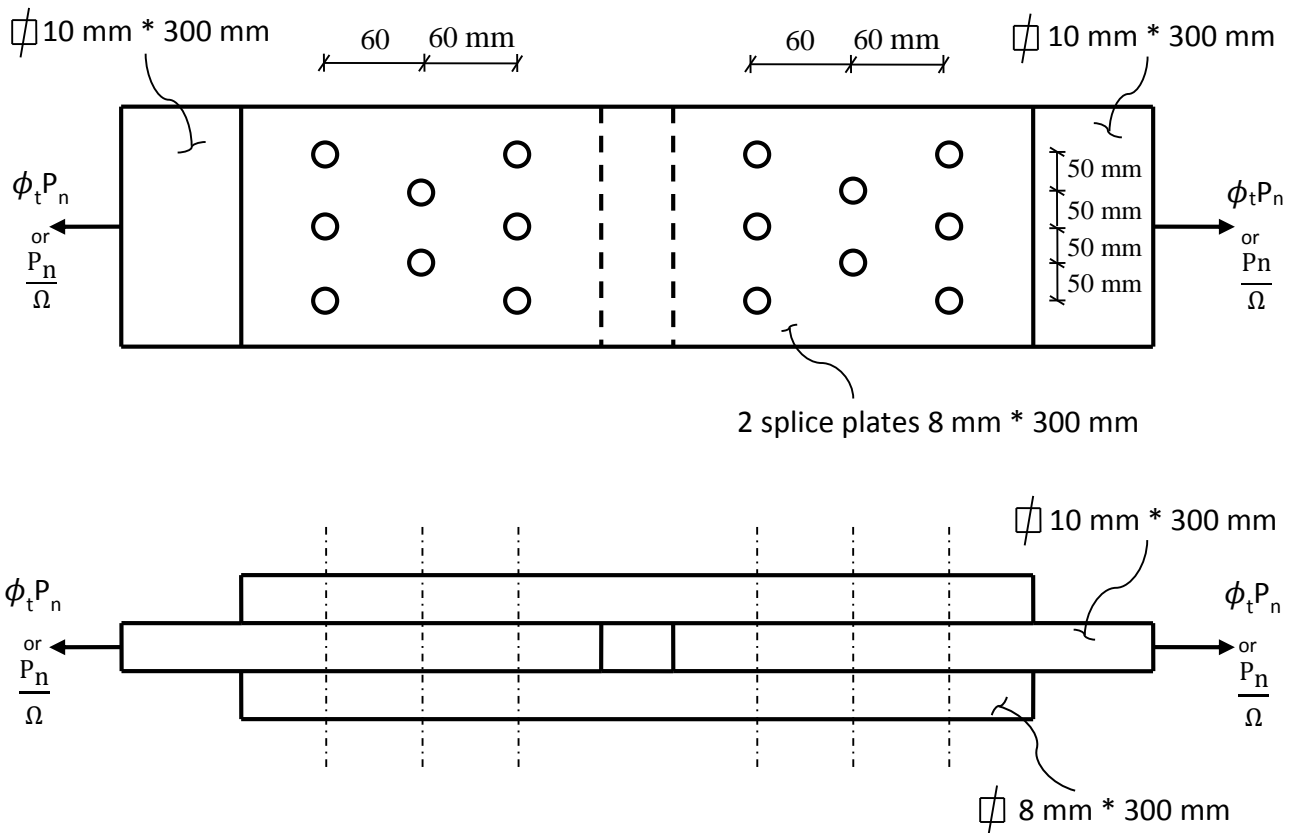
- 1) For the angle sections shown below calculate the following properties and compare it with the tabulated values. Comment on your findings.



Case	$h$ (mm)	$b$ (mm)	$t$ (mm)
A	120	120	12
B	200	100	12

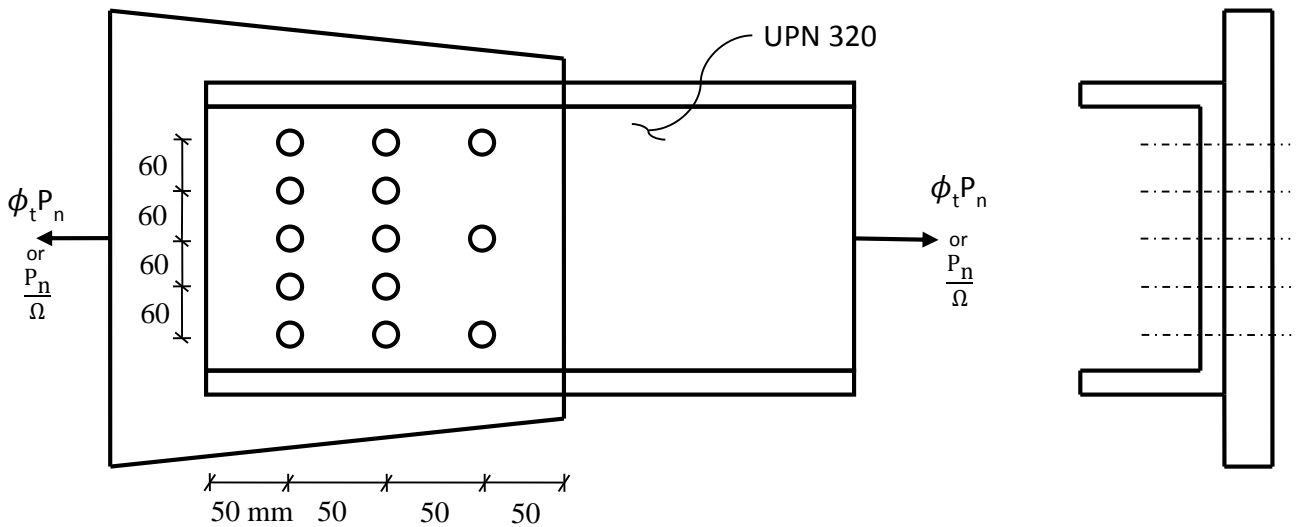
- Location of centroid ( $x_s$  and  $y_s$ )
- Moment of inertia with respect to  $x$  and  $y$  axes ( $I_x$  and  $I_y$ )
- Radius of gyration with respect to  $x$  and  $y$  axes ( $r_x$  and  $r_y$ )
- Moment of inertia with respect to the principal axes  $u$  and  $v$  ( $I_u$  and  $I_v$ )
- Radius of gyration with respect to  $u$  and  $v$  axes ( $r_u$  and  $r_v$ )
- Angle  $\alpha$  between  $y$ - $y$  and  $v$ - $v$  axes

- 2) Calculate design tensile strength ( $\phi_t P_n$ ) and allowable tensile strength ( $\frac{P_n}{\Omega}$ ) based on yield of gross section and fracture of net section.



S275 Steel ( $F_y=275$  MPa and  $F_u= 430$  MPa) and M16Bolts (Standard Holes)

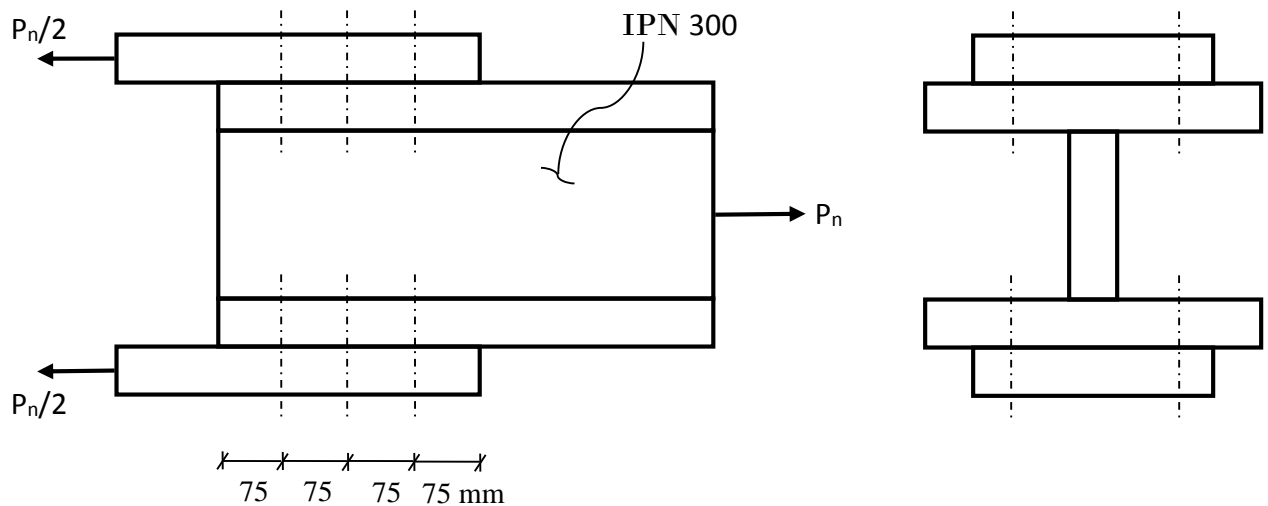
- 3) Calculate design tensile strength ( $\phi_t P_n$ ) and allowable tensile strength ( $\frac{P_n}{\Omega}$ ) based on yield of gross section and fracture of net section. (Assume gusset plate is OK.)



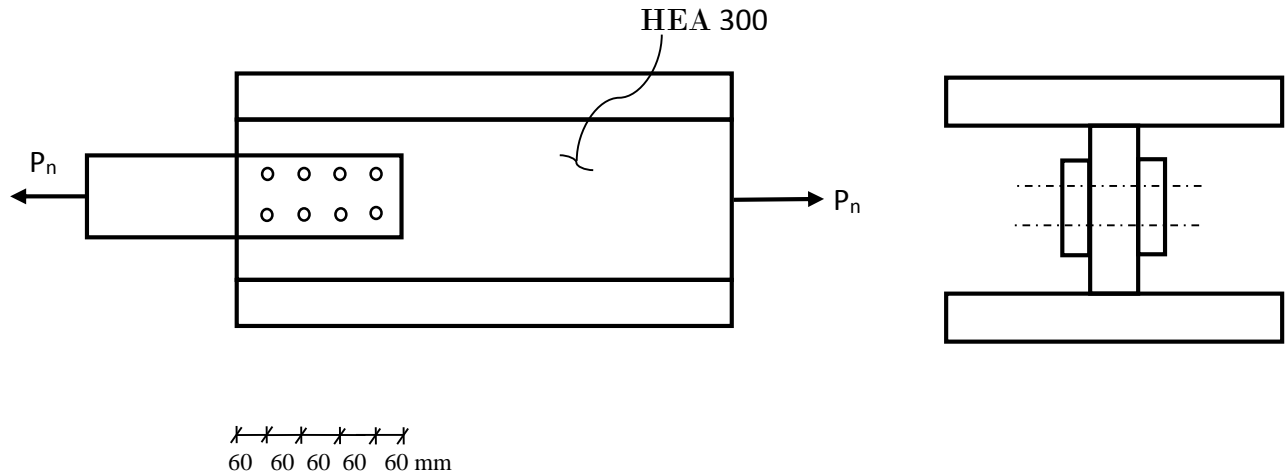
St 355 Steel ( $F_y=355$  MPa and  $F_u=510$  MPa) and M16 Bolts (Standard Holes)

- 4) Compute effective net area ( $A_e$ ) for the I-shaped tension members shown below.

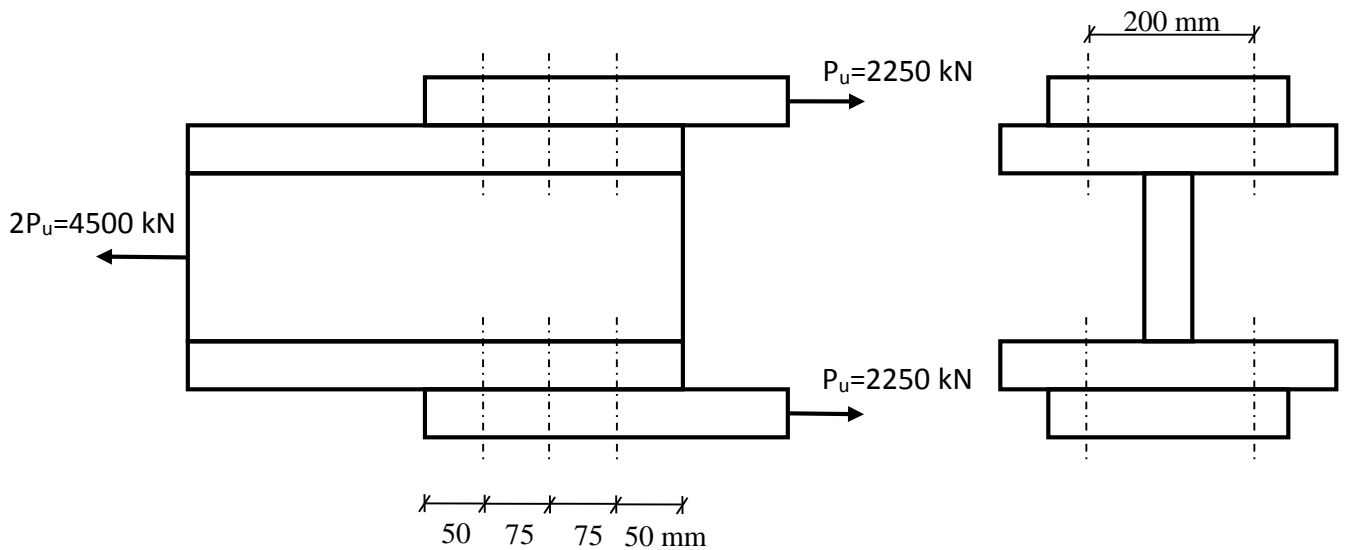
a)



b)



5)



An I - shape tension member is required to carry a factored load of 4500 kN. The member end is connected using two gusset plates. Find the lightest HEA, HEB or HEM sections of S235 Steel. ( $F_y=235$  MPa  $F_u=360$  MPa) Demonstrate that your member satisfies yield, fracture and block shear. Assume gusset plates are OK. Compare the weight of sections.

M22 bolts (Standard Holes)

- 6) For the tension member shown below determine if the member is able to safely carry the applied loads. Use LRFD and ASD separately and compare your findings. Given load are service loads (ie. unfactored loads). Gusset plates are OK.

M20 Bolts Standard Holes

S275 Steel  $F_y = 275\text{MPa}$ ,  $F_u = 430\text{MPa}$

Determine the maximum length ( $L_{\max}$ ) preferred for this tension member.

$D = 150\text{ kN}$ ,  $L = 250\text{ kN}$  (D: Dead Load, L: Live Load)

