

Name in Arabic :
Number:

Lecture time :

KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT

STEEL STRUCTURES : CE 473
SECOND SEMESTER, 1425/1426 H
TIME : 90 min

FIRST MID TERM EXAM

Answer all problems in the provided spaces

Problem 1 :

A pair of channels 310 x 45 are bolted to a 20 mm gusset plate, as shown in figure, with 9 M20, A325 bolts

(all dimensions in mm)

For steel , $F_y = 250$ MPa, $F_u = 400$ MPa

For bolts : $F_u = 620$ MPa, $F_v = 400$ MPa

For one Channle 310 x 45

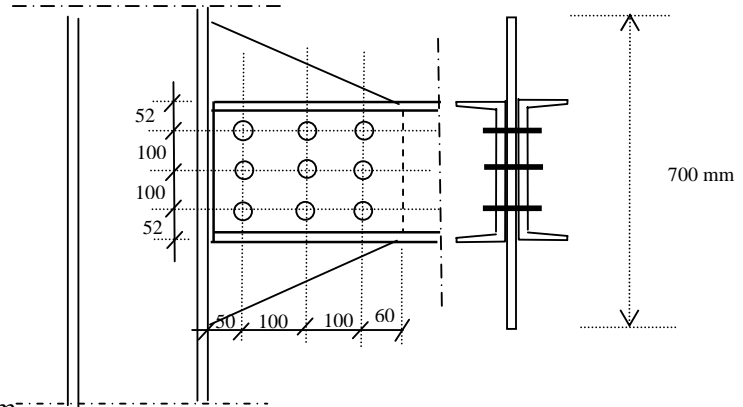
$A = 5690$ mm²

Flange width = 80 mm, flange thickness = 12.7 mm

Web thickness = 13 mm

c.g x-coordinate = 17 mm

1- Determine the maximum tensile strength of the two channles, Consider



a) Yielding at A_g

b) Fracture at A_e

c) Block shear rupture in web of the channles

Maximum Tensile strength of channels =

2- What would be the minimum guesst plate thickness to avoid block shear failure (U shape) in guesst plate ,
If $P_u = 2350 \text{ kN}$

Minimum thickness of guesst plate =

3- Determine the maximum strength of bolts, assume $\mu = 0.50$ and standard holes, Consider:

a) Slip-critical connection

b) Shear failure

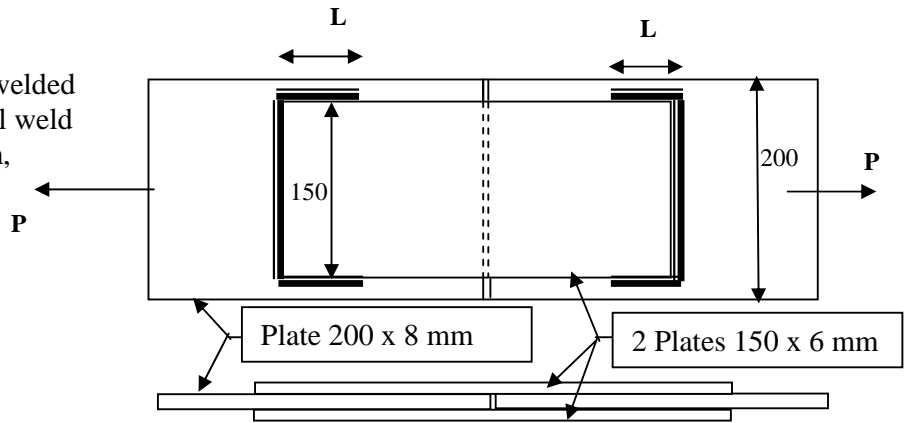
c) Bearing failure of plates

Maximum strength of bolts =

will the bolts be sufficient to resist $P_u = 1350$? Why?
If bolts are not sufficient what would be the failure mode of bolts?

Problem 2 :

If the two cover plates 150x6 mm were welded to the 200 x 8mm plate with a transversal weld of length equal 150mm, and size of 6mm, **on both sides**, as shown in figure, and $P_u = 700$ kN.
For weld : $F_{E70} = 500$ MPa



1- Will the transversal weld **only** be sufficient to resist the P_u ?
Consider,

a) Failure of transversal weld

b) Tensile fracture of cover plate

Is the transversal weld sufficient? Why?

2- If the transversal weld is not sufficient to resist the P_u , what would be the required length of longitudinal weld (L) needed for the splice? Consider;

a) Failure of longitudinal weld

b) Shear fracture of cover plate

Required length of longitudinal weld =