

Name in Arabic :
Number:

Lecture time :

KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT

STEEL STRUCTURES : CE 473
FIRST SEMESTER, 1427/1428 H
TIME : 90 min

FIRST MID TERM EXAM

Answer all problems in the provided spaces

Problem 1 :

A tension member made of W 130x 23.8 was spliced using two plates of thickness 8 mm each and width of 80 mm for web and one plate for each flange of thickness 10mm , as shown in figure. The bolts used for the **web splice** are **M12, A325 bolts**, While that used for **flanges splice** are **M18, A 325 bolts**, with the shown arrangements.

(all dimensions in mm)

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

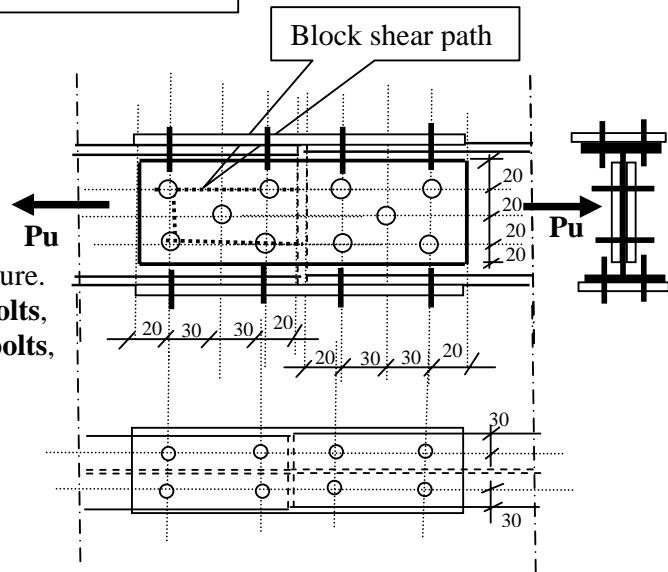
For bolts : $F_u = 620$ MPa, $F_v = 400$ MPa

For W 130 x 23.8

$A = 3010$ mm²

Flange width = 127 mm, flange thickness = 9.10 mm

Depth (d) = 127 mm, Web thickness = 6.1 mm



1- Determine the maximum tensile strength of the W 130 x 23.8 , Consider

a) Yielding at A_g

b) Fracture at A_e

i- Consider path 1-1

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ii- Consider path 2-2



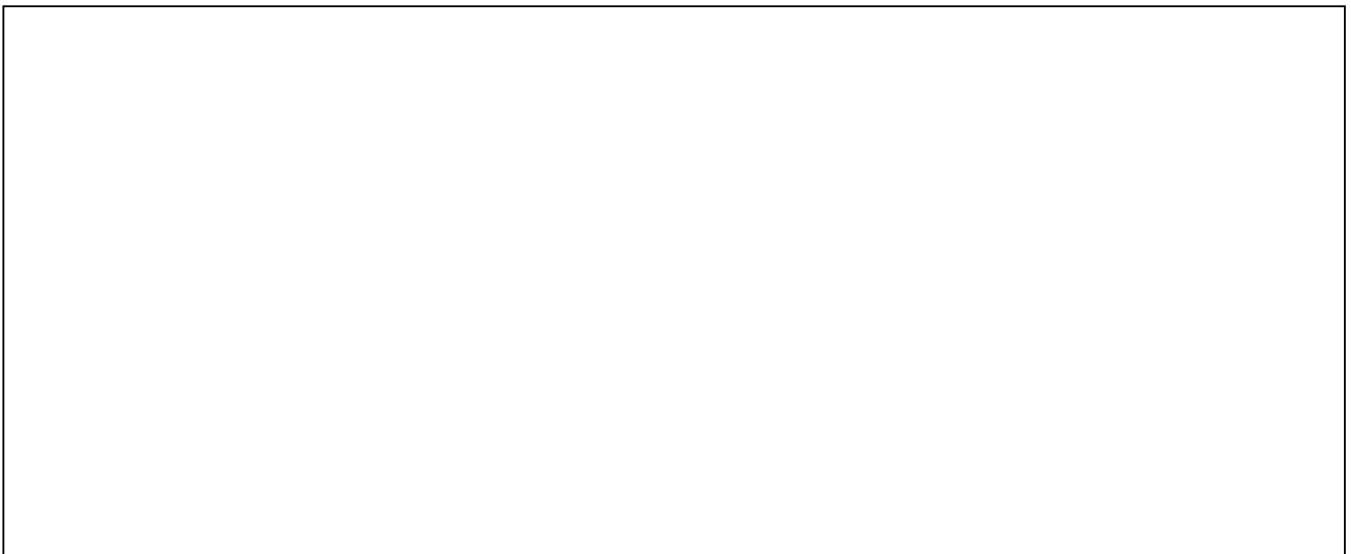
Governing Tensile strength for fracture at $A_e =$

c) Block shear rupture

i- Block shear **in web** of the W –shape (use only the shown path on figure)



ii- Block shear **in flanges**



iii- Factored strength of block shear for W 130 x 23.8 =

d) The governing Factored Tensile strength of W 130 x 23.8 =

2- If the splice is considered to be slip critical connection, with standard holes and $\mu = 0.50$

a- Determine the factored slip critical strength of the bolts

i- Factored Slip critical strength of bolts for **Web**

ii- Factored Slip critical strength for bolts for the **flanges**

iii- Total strength of slip critical connection =

b- Determine the factored shear strength of bolts

i- Factored shear strength of bolts for **web**

ii- Factored shear strength of bolts for **flanges**

iii – Total factored shear strength of bolts

c- Determine the factored bearing strength of bolts

i- Factored bearing strength of bolts for **web**

ii- Factored bearing strength of bolts for **flange**

iii- Total factored bearing strength

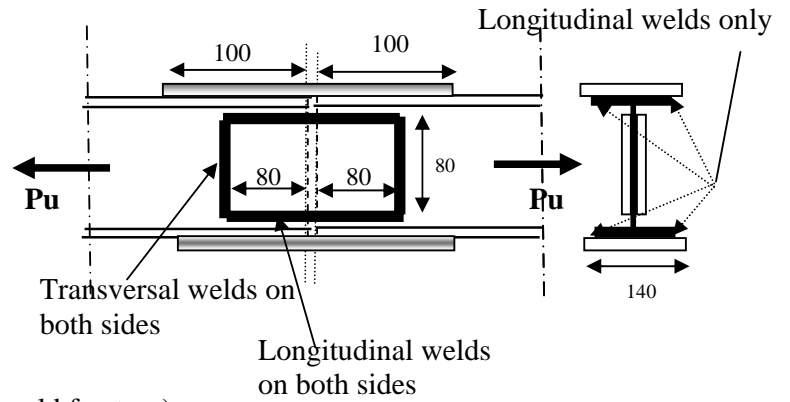
d- Factored strength of the connection

Problem 2 :

If the two splice plates 80 mm wide were welded to the web of the W 130 x 23.8 with both Longitudinal and transversal welds.

In addition, each flange was spliced with a 140 mm wide plate with only longitudinal welds of length equal 100 mm on each side.

All weld sizes are 8mm and $F_{E70} = 500$ MPa



1- Determine the strength of welds (consider only weld fracture)

i- Factored strength of welds for **web**

ii- Factored strength of welds for **flanges**

iii- Factored strength of the group of welds