



**King Saud University
College of Engineering
Department of Civil Engineering**

FINAL EXAM

CE 473 Steel Structures – 2nd Semester 1426 - 27 H

Tuesday, 10th, Jumada I, 1427

Time allowed: 3 hrs

| | |
|-------------------------------------|--|
| Student name (In Arabic) | |
| Student number | |
| Section Time | |

Total number of Questions: 5

Attempt all questions

| Questions | Maximum Marks | Marks obtained |
|--------------------|----------------------|-----------------------|
| Q # 1 | 6 | |
| Q # 2 | 8 | |
| Q # 3 | 14 | |
| Q # 4 | 12 | |
| Q # 5 | 10 | |
| Total marks | | <u>50</u> |

Total marks obtained (in words): _____



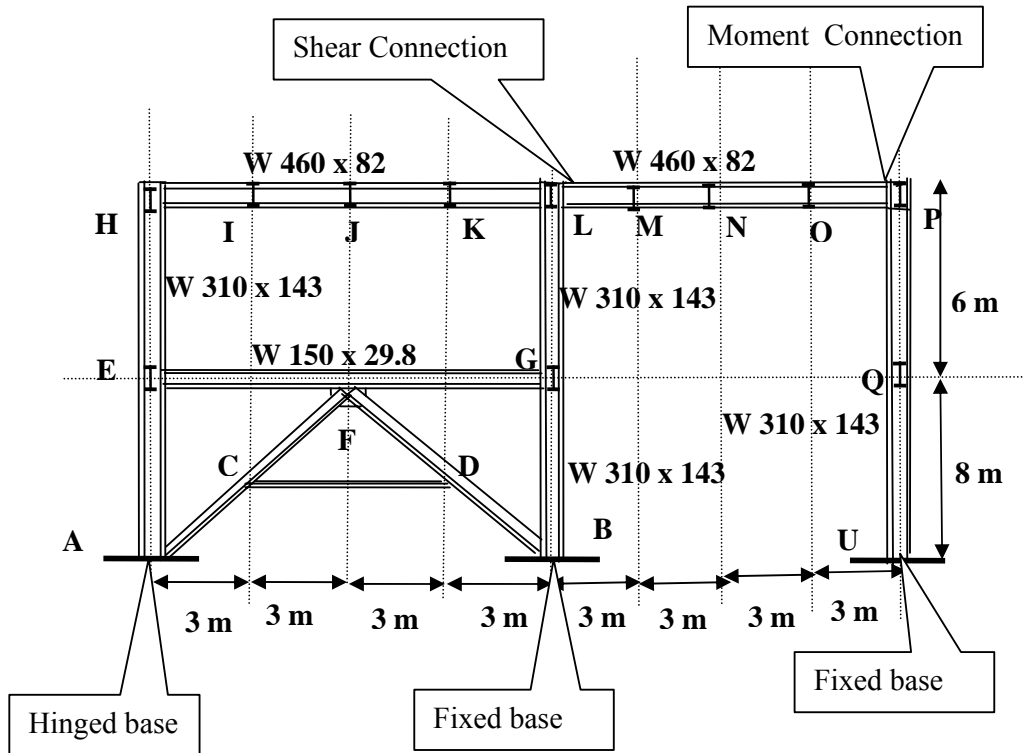
Student name

Marks obtained for Q1

Student number

Answer all problems in the provided spaces

The shown frame is made of steel A36, with hinged base at A, and fixed base at B and U and laterally supported at E, G, H, I, J, K, L, M, N, O, P and Q. All columns are made of W 310x143. Beam LMNOP has a shear connection at L and a moment connection at P. The top and bottom flanges of beam LMNOP are laterally supported at points L, M, N, O and P.



1- Determine the buckling lengths, KL_x and KL_y of column BG, assume the column is pinned outside the plane at point G.



Student name

Marks obtained for Q2

Student number

2-

(a) Determine the buckling lengths, KL_x and KL_y of column UQP, assume the column is pinned outside the plane at point P and Q.

(b) If the base of column UQP is fixed, and the factored normal force at base = 1000 kN, and the factored moment at base = 100 kN.m, determine the minimum base plate length, so that no tensile stress occur under the base plate.

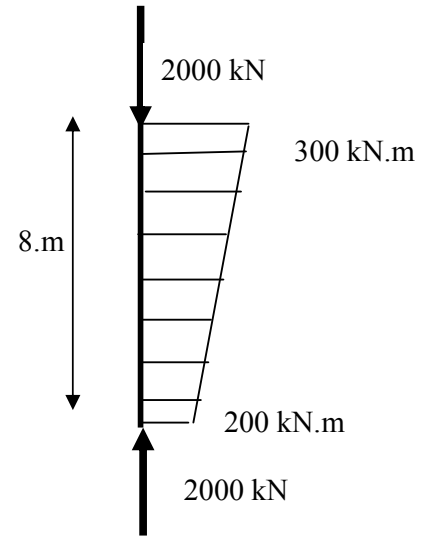


Student name

Student number

Marks obtained for Q3

3- If column BG has the shown factored bending moment and a factored axial load, and its $KL_x = 6.40$ m and $K_{ly} = 8.0$ m, and its section is W 310x143, check its safety .





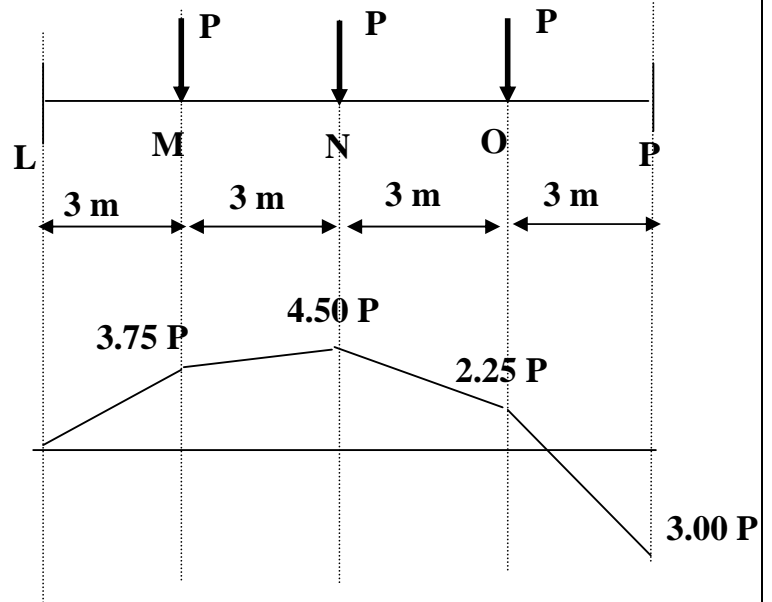
Student name

Marks obtained for Q4

Student number

4- The beam LMNOP has the shown bending moments in terms of the concentrated load (P), and its top and bottom flanges are laterally supported at points L , M , N , O , and P , and its section is W 460 x 82.

a) Identify the zone that has the least factored flexural resistance



b) Determine the least factored bending resistance of the beam



Student name

Student number

Marks obtained for Q4

- c) If the least factored moment of resistance of the beam is 365 kN.m, and the service concentrated Live load (P_L) = 0.5 of the service concentrated dead load (P_D), determine the maximum service concentrated dead (P_D) and (P_L) live loads to be acting on the beam.

Hint : Use the following load combination $1.2 D + 1.6 L$

- d) If the service concentrated Dead load $P_D = 60$ kN, and the service concentrated live load $P_L = 30$ kN, **find** the lightest W shape section for the beam LMNOP, and **determine** its factored resistance.

Hint : Use the following load combination $1.2 D + 1.6 L$

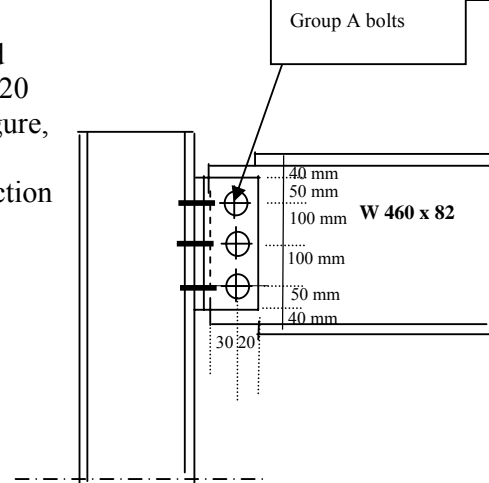


Student name

Student number

Marks obtained for Q5

5- If the shear connection between the beam LMNOP and column GL is made of 2 angles 64 x 64 x 9.5mm and M20 bolts and the flanges of the beam was cut as shown in figure, given that $F_{v \text{ bolt}} = 400 \text{ MPa}$ and all steel used is A36, determine the factored strength of the given shear connection taking into account



1- Shear failure of group A bolts

2- Bearing failure of group A bolts

3- Block shear of the **web of the beam**

4- Factored Shear resistance at critical section of beam

5- Factored shear strength of the connection =

