DESIGN OF STEEL STRUCTURES

FINAL EXAM

ATTEMPT ANY FOUR QUESTIONS

TIME: 3 Hours.

QUESTION ONE:

Calulate the strength of a 20 mm diameter bolt of grade 4.6 for the following cases. The main plates to be joined are 12 mm thick.

a) Lap Joint
b) Single Cover Butt Joint: the cover plate beig 10 mm thick.
c) Double Cover Butt Joint: each of the cover plate being 8 mm thick.

For Fe 410 grade of steel fu= 410 Mpa = 410N/mm^2

For bolts of grade 4.6: fub = 400 Mpa = 400N/mm^2

$\gamma_{mb} = partial\ safety\ factor\ for\ the\ material\ of\ bolts = 1.25$

$A_{nb} = Net\ tensile\ stress\ area\ of\ 20\ mm\ diameter\ bolt = 0.78\ X\ \frac{\pi D^2}{4} = 245\ mm^2$

QUESTION TWO:

Two plates of 16 mm and 14 mm thickness are joined together by a groove weld. The joint is subjected to a factored tensile load of 430 kN. Due to some reasons the effective length of weld that was provided was 175 mm. Check the safety of the joint if

a) Single V Groove joint is provided **[10 Marks]**
b) Double V Groove joint is provided **[10 Marks]**

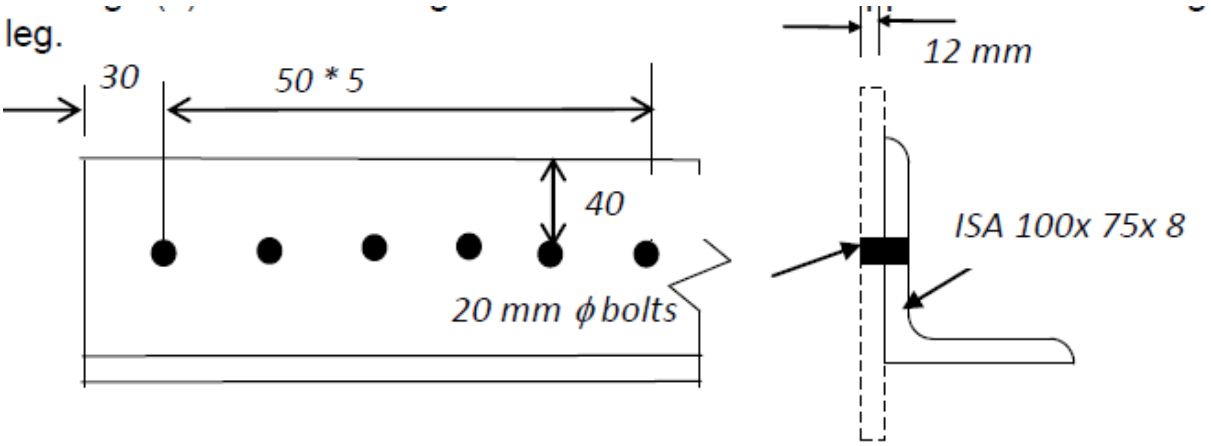
QUESTION THREE:

Determine the buckling strength of a W 12 x 50 column. Its length is 20 ft. For major axis buckling, it is pinned at both ends. For minor buckling, is it pinned at one end and fixed at the other end. **[20 Marks]**

QUESTION FOUR:

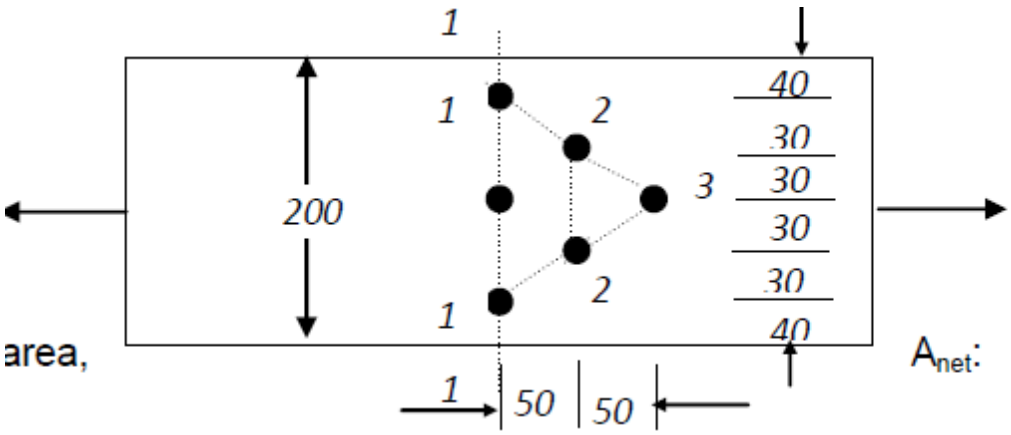
Asingle unequal angle 100 X 75 X 8 mm is connected to a 12 mm thick gusset plate at the ends with 6 nos. 20mm diameter bolts to transfer tension. Determine the design tensile strength of the angle. **[20 Marks]**

a) If the gusset is connected to the 100 mm leg.
b) If the is connected to the 70 mm leg
c) If two such angles are connected to the opposite sides of the gusset through 100 mm leg.



QUESTION FIVE:

Determine the design tensile strength of the plate (200 X 10mm) with the holes as shown below, if the yield strength and the ultimate strength of the steel used are 250 MPa and 420 MPa and 20mm diameter bolts are used. **[20 Marks]**



area, A_{net}:

END OF EXAM