EL-Mansoura University
Faculty of Engineering
Structural Eng. Dept.
Time: 4 hours

بسم الله الرحمن الرحيم

3rd Year Civil
Steel Structures.
Final Examination
Date: 09 / 6 / 2014

Part One : (Maximum Grade 60 Marks).

Any Data Missing can be Reasonably Assumed.   Material of Construction is Mild Steel 37
All Sketches Should be Clear.

Answer All the Questions:-

The steel Structures shown in Figure (1) is one of series that form the skeleton of a workshop.
The spacing between trusses is equal to 5.0m; the roof truss is divided into 6-panels 3.0m each.
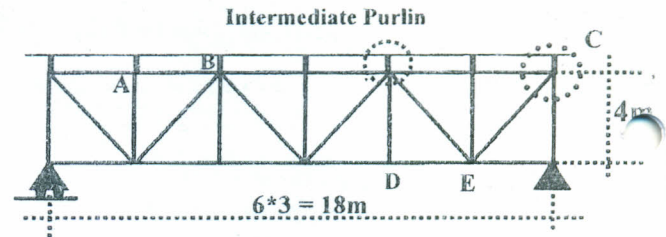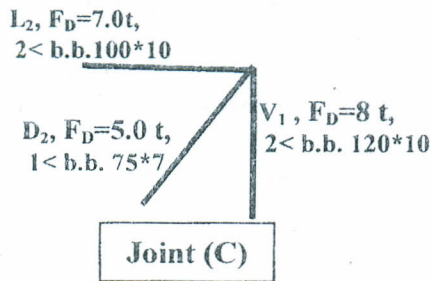

L$_2$, F$_D$=7.0t,
2< b.b.100*10

D$_2$, F$_D$=5.0 t,
1< b.b. 75*7

V$_1$, F$_D$=8 t,
2< b.b. 120*10

Joint (C)

Intermediate Purlin

6*3 = 18m

4m

Figure (1)

Question 1: (5 Marks)
Design the upper Chord member "A-B" as a compression member shown in Figure (1) if the design force "F_D= 10t Case A", $L_{bx} = L_{by} = 300cm$, Diameter of Bolt = 16mm (Grade 5.8), thickness of Gusset Plate = $t_{GPL.} = 10mm$.

Question 2: (10 Marks)
Design the market intermediate Continuous purlin shown in Figure (1), using Tie rod at mid-span (neglected Wind Loads)

Question 3: (10 Marks)
Design and Draw to Scale 1:10 the Connection "C" shown in Fig. (1) as bolted Connection.
Diameter of Bolt = 16mm   Grade (5.8), thickness of Gusset Plate = $t_{GPL.}$ = 10mm.

Question 4: (10 Marks)
Design and Draw to Scale 1:10 the Connection "C" shown in Fig. (1) as Welded Connection.

Question 5: (5 Marks)
For the Tension member "D-E" shown in Fig. (1), if the total length = 300cm, and the cross section of this member is 2< 80*80*10. Determine the Design force of this member.
($F_{all.t}$=1.4t/cm^2), Diameter of Bolt = 16mm, thickness of Gusset Plate = $t_{GPL.}$ = 10mm.

Question 6: Variant Questions (20 Marks)

6-1) Give Short Account about Importance Of Tie Plate in Compression members:
   i).............................ii)...............................iii)...........................

6-2) Disadvantages of Welded Connections:
....
....

6-3) Differences between Pretensioned and Non-Pretensioned Bolts :
....
....
....
....

6-4: Components of Stresses in Fillet Weld:
   i)..
   ii)..
   iii)..

6-5): For Pretensioned bolts, where the forces acting transverse to the Shank of
   the Bolt are Transmitted by:
    i) Friction (Slip) between the Contact Surfaces of the connected components.
    ii) Shear or Bearing.
    iii) Shear plus Friction between the Contact Surfaces of the connected components.

6-6): For Non-Pretensioned bolts, where the forces acting transverse to the Shank of
   The Bolt are Transmitted by:
    i) Friction (Slip) between the Contact Surfaces of the connected components.
    ii) Shear or Bearing.
    iii) Shear plus Friction between the Contact Surfaces of the connected components.

6-7): For Intermittent Fillet Weld, the Clear Distance between effective Lengths
   (L_1 or L_2) consecutive Intermittent in Tension Member is equal to:
    i) (L_1) or (L_2) $\leq$ 16t or 16t_1 or 20cm - Whichever is Smaller.
    ii) (L_1) or (L_2) $\leq$ 12t or 12t1 or 20cm - Whichever is Smaller.
    iii) (L_1) or (L_2) $\leq$ 20t or 20t1 or 20cm - Whichever is Smaller.

6-8): For Intermittent Fillet Weld, the Clear Distance between effective Lengths
   (L_1 or L_2) consecutive Intermittent in Compression Member is equal to:
    i) (L_1) or (L_2) $\leq$ 20t or 20t1 or 20cm - Whichever is Smaller.
    ii) (L_1) or (L_2) $\leq$ 16t or 16t_1 or 20cm - Whichever is Smaller.
    iii) (L_1) or (L_2) $\leq$ 12t or 12t1 or 20cm - Whichever is Smaller.

6-9) Common Types of Covering Materials on Roofs for any Truss:
   a)........................... ....   b)...............................

6-10) Advantages of Steel
   a)...............................b)....... ....c)...............................
   d)...............................e)....... ....f)...............................

With Best Wishes

Examiner
Prof. Dr. Saad Eldeen Abdrabou

Question (1) [40 marks]

The steel frame shown in figure is one of series that form the skeleton of a work shop. The frames are composed of steel Portal frame "A-B-C-D-E" supported on two hinged steel columns "A-B" and "E-D" to cover an area (24.0 X 50.0) m². The frame spaced 5.0 ms. apart. The part "F-G-H" is a mezzanine part with fixed steel column "F-G" and supported with hinge at "H". The roof covering is a corrugated steel sheets. Its required to:
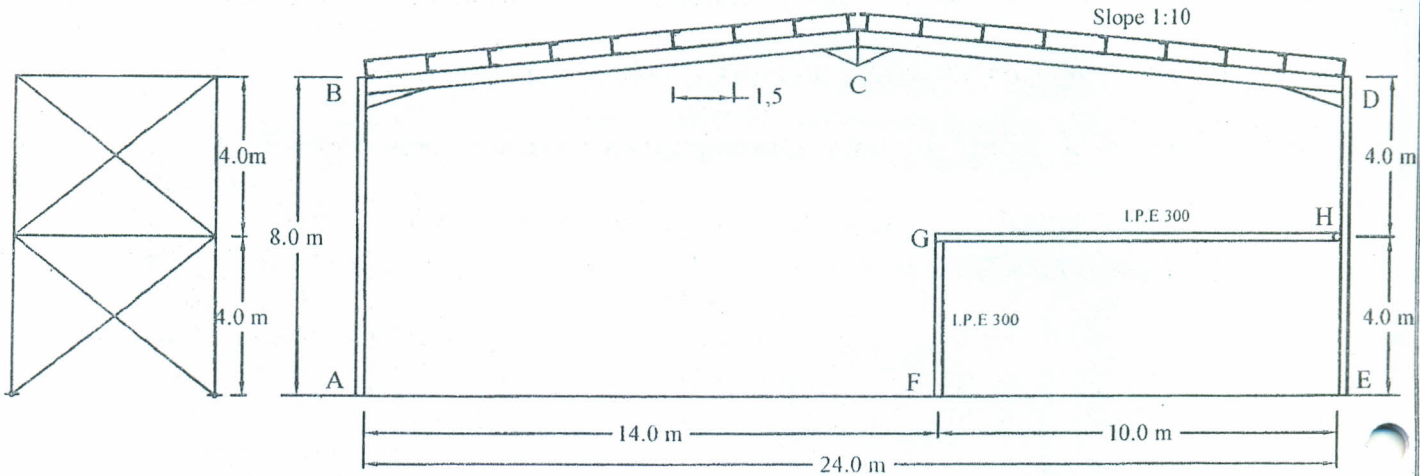
1- Draw a roof plan showing the upper bracing and explain how the load can be transmitted to the foundation?

2- Calculate the Buckling lengths for columns "A-B, F-G" in the plane of the main frame and out of plane?

3- Find a suitable B.F.I section for the column "A-B" M=24 m.t, N=10 ton and Q = 8.0 ton?

4- Find a suitable I.P.E section for the rafter "B-C-D" M = 24 m.t and Q = 10 ton?

5- Check the column composed of 2-S.I.B No 36 spaced 60 cm, M = 48.24 t.m "case B", the corresponding normal force N = 53.6 ton "case II", (L_{by} = 12.0 m, L_{bx} = 4.0 m)? Height for the column = 8.0 m, Design batten plate for column?

6- Design the rigid connection between the rafter and the column at B using M20grade 10.9 Pretension High strength Bolts, the straining action at joint "B" are M = 24 m.t, N = 8 ton and Q = 10 ton?

7- Design the hinged base connection (N = 30ton & H=3ton) where the cross section of the column is B.F.I No. 300?

8- Calculate the design values for the following frame sections Mmax & Ncorr and Nmax & Mcorr?

| Sec	D.L		L.L		W.L.L		W.L.R		M_{max} & N_{corr}		N_{max} & M_{corr}	
	M	N	M	N	M	N	M	N	M_{max}	N_{corr}	M_{corr}	N_{max}
1	-4.20	-2.10	-5.30	-2.10	4.30	-0.90	-1.60	1.40				
2	-6.90	-1.80	-7.70	-2.20	5.30	1.90	0.40	0.60				
3	-6.80	-1.20	-7.50	-1.60	5.20	0.70	-0.50	0.70				

With my best wishes
Dr. Fikry. A.Salem

Question (2) [20 marks]

(1) Write short notes with sketches about:-
   a. Compact, non-compact and slender sections.
   b. Overall buckling, local buckling and lateral torsional buckling.
   c. Differences between lacing bars and batten plates.
   d. C_b and C_m factors.
   e. Allowable stresses for any type of stresses.
   f. Calculate the factor C_m for the column.

(2) For the flexible bolted connection shown in fig. (1), check the given number of bolts, if the connection subjected to Q=20.0 ton [using bolts M20 grade 6.8])?

(3) For the flexible welded connection shown in fig. (2), check the maximum size of weld, if the connection subjected to force =20 ton, thickness of Gusset plate = 8 mm?

B.F.I. No.(400)

2<70x 70x7

B.F.I.No. (320)

Fig.(1)

2 line of weld 250 mm x S mm

Fig.(2)

45°

20 ton
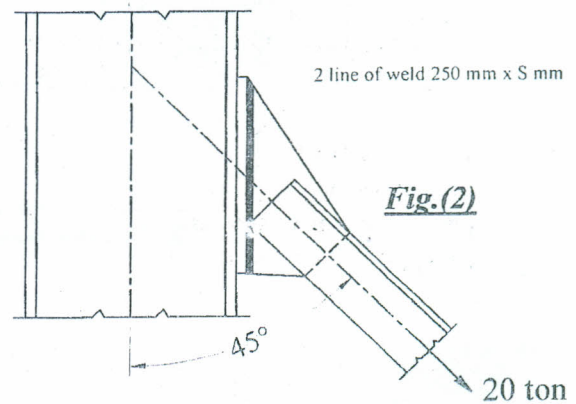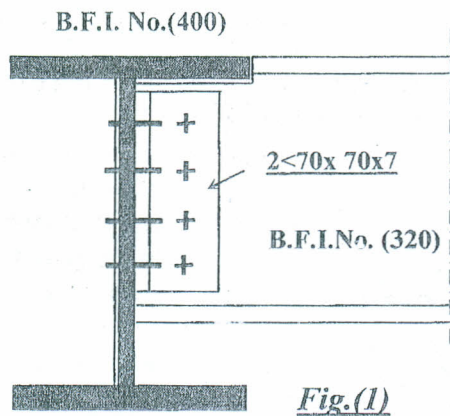
(4) For the bracket connection shown in fig. (3), without any calculations, explain the differences in stress distribution for the bolts between the end plate and the column in case of non-pretension bolts and pretension bolts?

(5) For the eccentric bolted connection shown in Fig. (4), determine the force in each bolt [using M20 grade 5.8]?

P=10

P=20 ton   e=10 cm

50 cm

I.P.E 400

B.F.I 400

Fig.(3)

P=10

Channel No. (400)

e=10 cm

One Plate t=1,2

← 30 cm →

Fig. (4)

With my best wishes
Dr. Fikry. A.Salem