Kafrelsheikh University
Faculty of Engineering
Departmentof CivilEngineering
3rd year, Design of Steel Structures

Academic Number:CES3010

Date: 29- 5 - 2016
Timeallowed: (4) hours
Full Mark: 75
Final Exam: 2 pages

Notes: - Assume any missing data reasonably. - Only steel tables and formula sheets are allowed.
- Unless otherwise noted, steel used is St. 52

Question 1

1- The outline of an industrial halls shown in **Figure (1)**. Columns are not allowed inside the hall, it is required to choose suitable systems for covering this area under the following conditions:
   - Main entrance is 8.0 m width at side B-C.
   - Natural light must be well distributed on the hall.

   It is required to draw with a suitable scale elevation, side view, end gable and plan showing the different arrangement of bracing system.

2- **Determine** the maximum ultimate load **(w)** that can be applied on the simple beam where its section is BFIB 400 for the both given cases, to satisfy **flexure strength** and **deflection** requirement;
   1-**Case 1;** the top flange is continuously laterally supported by RC slab.
   2- **Case 2;** the top flange is only laterally supported at ends.

3- **Design** a crane track girder with 6.0 m span using HEA section assuming the maximum reactions of the crane are two loads 15.0 tons each and spaced 1.5 m (Consider the dynamic effect (I) = 25% and the lateral shock = 10%).

Question 2

1- **Design** a column using four angle –open section from two sides- to carry a total load of 120 t, case I. The column is hinged at both ends with buckling length Lbx = Lby = 7.0 m, St 37, Ø = 16 mm with grade 4.6 [**Hint**: use double lacing bars]

2- **Discuss** with neat sketch the **buckling** length factor for members with well defined end conditions, **mention** example on each case

3- **Calculate** the buckling lengths for column shown in **Figure (2)**,. Assume there is vertical bracing outside plane connecting columns at floor levels only

Question 3

1- Design the hinged base connection (N = 40 t & H = 5.0 t) where the cross section of the column is two BFIB NO 300.

2- **Draw** the flow force diagram for the fixed base at joint (*A*) of **Figure (3).**

3- **Design and draw** the rigid connection at joint (*B*) of the frame shown in **Figure (3)** if N = -15.0 ton, Q = 10.0 ton and M=25.0 m.t., using [M 30 grade 8.8] pretensioned bolts. The rafter is HEA 500

4- A composite beams cover an area of 7.0 ×15.0 m^2 each beam is simply supported with span 7.0 m and spacing between beams is 1.5 m. The slab thickness 12.0 cm with hunch 7.0 cm. The floor cover=150 kg/m^2,Live Load=400 kg/cm^2. The interface between the concrete slab and the steel beam is assumed to be a full connection type. It is required to **design the composite beam to satisfy the flexure and deflection criteria**. Take St 37 and F_{cu} =300 kg/cm^2 (f_c= 95 kg/cm^2) [**Hint**: use minimum steel height]

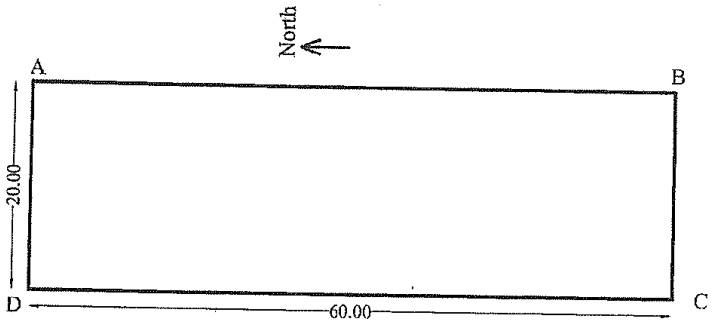

Figure 1

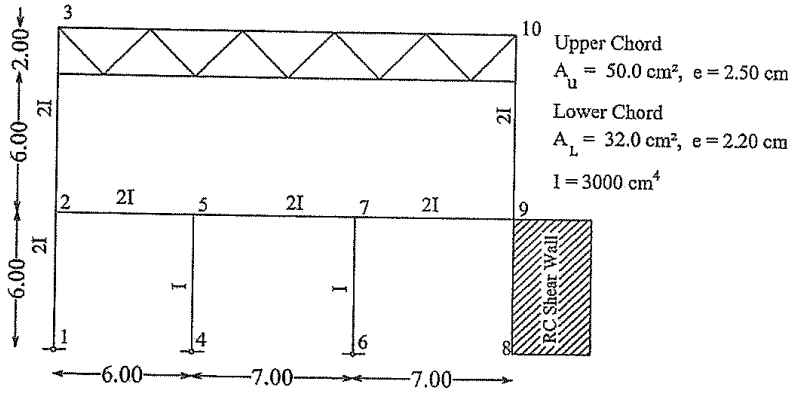

Figure 2

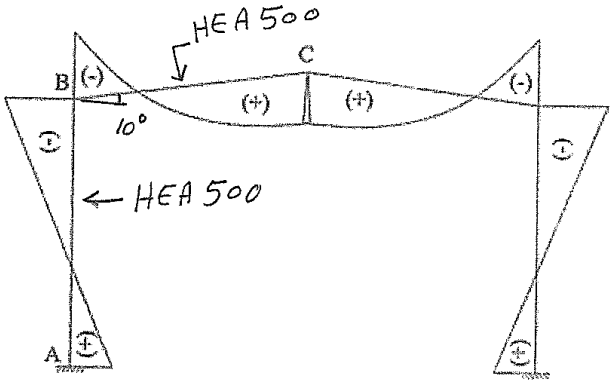

Figure 3

Best Wishes

Dr. Ali M. Basha