Kafrelsheikh University
Faculty of Engineering
Department of Civil Engineering
3rd year, Design of Steel Structures
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Date: 29 - 5 – 2019
Time allowed: (4.0) hours
Full Mark: 75
Final Term Exam: 2 pages
Academic Number: CES3010

Notes: - Assume any missing data reasonably.
   - Only steel tables and formula sheets are allowed.
   - Unless otherwise noted, steel used is St. 44

1- For the steel frames shown in **Figure (1)**, calculate the in-plane buckling length of the marked members (Columns *ab*, *bc* and *de*).   **(10 Marks)**
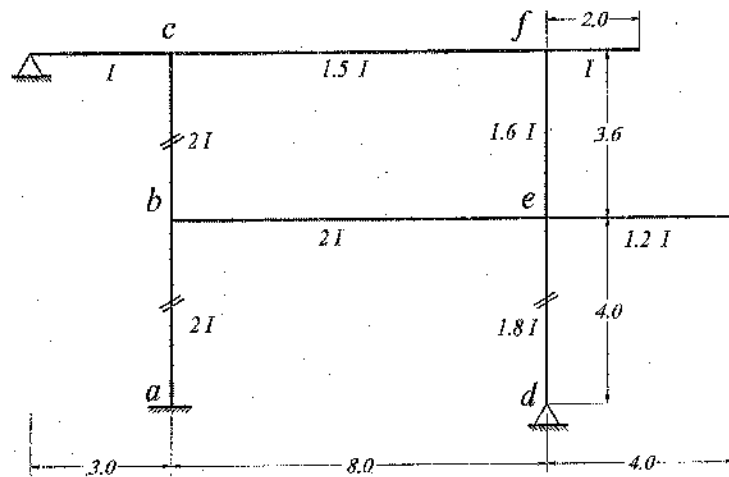

Figure (1)

2- Design the hinged welded column base at joint (*A*) of **Figure (2)** if N = 12.50 ton and Q = 4.0 ton. The column section is IPE 500 (Anchor bolts = 20 mm diameter and F_b concrete = 60 kg/m^2).   **(10 Marks)**

3- Design and draw the rafter to column rigid connection at joint (*B*) of the portal frame shown in **Figure (2)** using [M 20 grade 10.9] pretension bolts. The rafter is IPE 500 and the column is HEB 500 taking the prying force into consideration.   **(10 Marks)**
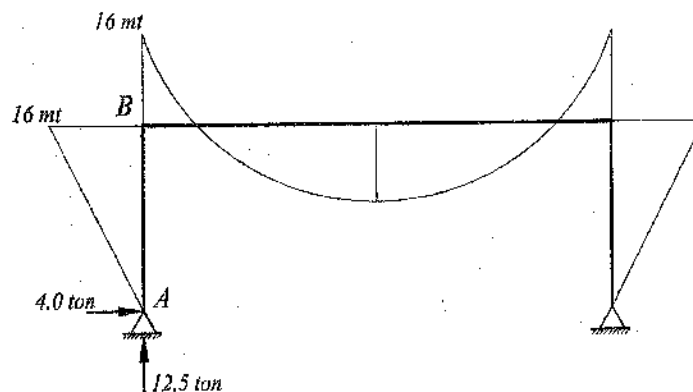

Figure (2)

4- Design a column carrying a normal force (N = -70 tons) and a bending moment (M = 30 m.t.) using an HEB profile. (L_{in} = 10.0 m & L_{out} =5.0 m, C_b=1.0, side sway permitted). **(5 Marks)**

5- Design a crane track girder with 6.0 m span using HEB section assuming the maximum reactions of the crane are two loads 10.0 tons each and spaced 2.0 m (Consider the dynamic effect (I) = 25% and the lateral shock = 10%). **(10 Marks)**

6- A column with open section is composed of 2 UPN 300 as shown in **Figure (3)**. The column is subjected to N = -70 ton (case II). Check the safety of the column assuming L_{in} = 8.0 m & L_{out} =4.0 m. (design of lacing bars is required assuming the inclination angle is 45^0). **(10 Marks)**
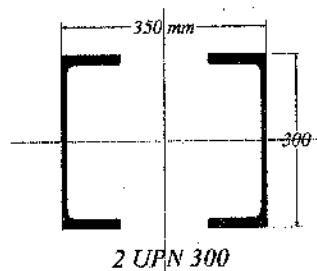

Figure (3)

7- Find the maximum live load which can be carried by simply supported composite beams shown in **Figure (4)** with 6.0 m span using rigid connectors then, design the stud shear connectors. Take the floor cover 200 kg/m^2 and Fcu =250 kg/cm^2. **(10 Marks)**
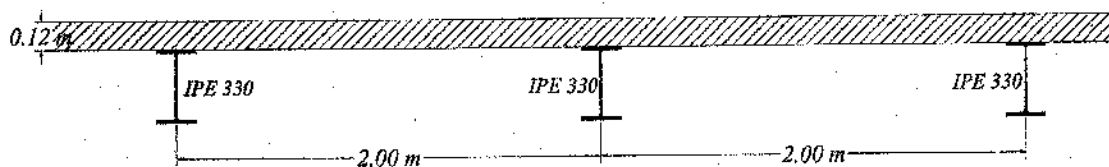

Figure (4)

8- Select suitable system to cover a factory in Kafrelsheikh over an area (48x23)

   a- Draw a general layout of the building (roof plan, main system elevation and side view) showing the arrangement of all bracing systems. Use a scale of 1:20

   b- Compute the dead, live and wind left loads for the intermediate system. **(10 Marks)**

With my Best Wishes: Dr. Fathi Abdelazeem