



Allowed Tables and Charts: *Tables of Steel Sections*

This exam measures ILOS No: (a4.1, a4.2, a13.1, a13.2, a14.2, b13.1, b15.1, d3.1)

- Drawings should be neat, detailed and fully dimensioned.
- Any missing data may be reasonably assumed.

Read carefully the given data and solve the required questions. (Total Marks: 115)

The sketches shown in the attached sheet present a structure system used to cover a workshop of dimensions (20m x 36 m). The structure comprises 7 frames spaced at 6.0 m. Each frame, shown in Figure (1), has a span of 20m and is supported from the left side to the column **XY** and supported from the other side on framed truss with 36 m span as shown in Figure (2). The frame carries a Monorail crane with loads given in the following data.

Given:

- Total Design Load = 120 kg/m²
- Design Wind Load = 75 kg/m²
- Crane Load = 2 x 4 @ 2.0 ms
- Steel to be used = ST.37
- Weld = Class I
- Gusset Plate Thickness = 12 mm
- Bolts for field connections = HSFG bolts M22 (10.9)
(For M20, A = 3.8 cm², A_{net} = 3.03 cm², T_o = 19.08 t, and P_s = 6.10 t)

Required:

1. Draw to a scale 1:100 all necessary views of the bracing system required for the stability of the structure. [15 Marks]
2. Design a suitable **C-section for Side Purlin at Column XY** using one tie rod system [10 Marks]
3. Determine the maximum straining action on the **column XY for the Cases A & B.** [10 marks]
4. Design the marked members at **Joint F.** [15 marks]
5. Design **Connection F** as Field Connection. [10 marks]
6. Design a suitable cross section for the crane girder shown in **Connection G** [15 marks]
7. Design a suitable cross section for the **Column ABC** [15 marks]
8. Draw to scale 1:10 full details for the part included in the dashed rectangle in Figure 2. (Use suitable sections for un-designed members) [15 marks]
9. Explain briefly the main functions of the bracing system [5 marks]
10. Mention the common structural welding problems [5 marks]

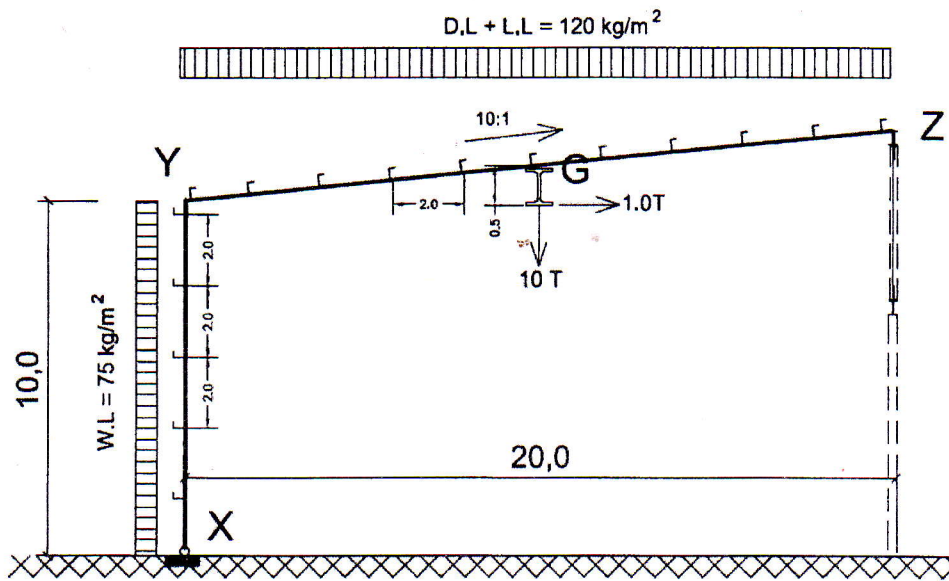


Figure (1)

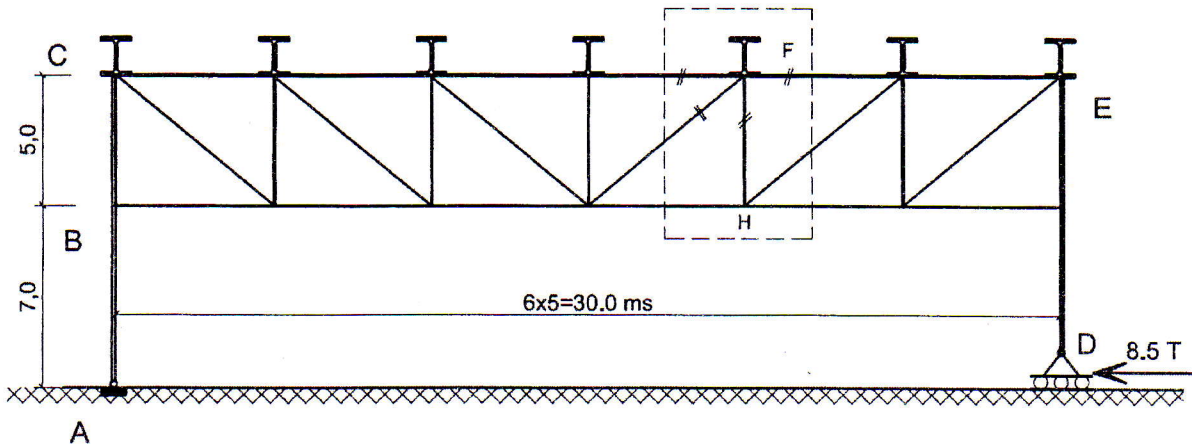
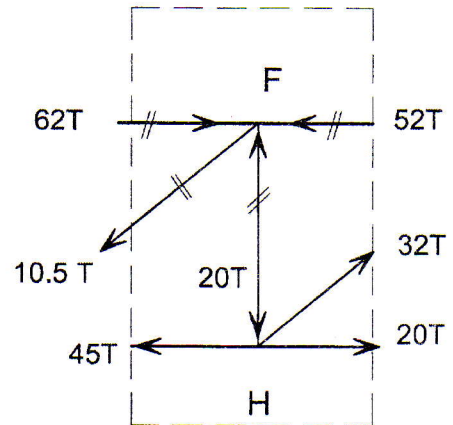


Figure (2)



With my Best wishes,,,