USN ☐☐☐☐☐☐☐☐☐☐      **10CV82**

## Eighth Semester B.E. Degree Examination, July/August 2022
# Design and Drawing of Steel Structures

Time: 4 hrs.                              Max. Marks:100

*Note:* 1. *Answer any ONE full question, each from PART-A and PART-B.*
        2. *Use of IS-800-2007, SP6(1) or steel tables is permitted.*
        3. *Missing data may be suitably assumed.*

## PART – A

1 a. A secondary beam of ISLB-400 @569 N/m is connected to the web of main beam ISMB-500@869 N/m on one side of the main beam by bolted framed connection. The top flange of the beams are maintained at the same level. Two frame angles of ISA – 100 × 100 × 10 mm of required length are used for connection. Each frame angle is connected to the web of secondary beam through 4 bolts of 20 mm diameter and to the web of main beam through 4 bolts of 18 mm diameter. Draw to a suitable scale.
   (i) Elevation of main beam with section of secondary beam.              **(07 Marks)**
   (ii) Elevation of secondary beam with section of main beam.             **(08 Marks)**

   b. A built up column is composed of two ISMC 300 placed back to back at a clear distance of 200 mm. They are connected together by battening system. The battens are spaced at 1250 mm. The end battens are of size 320 × 300 × 6 mm with 6 mm size fillet weld all-round the plate at each of connection. The intermediate battens were of size 320 × 250 × 6 mm with 4 mm size fillet weld all-round the plate at the end of connection.
    Draw to a suitable scale: (i) Elevation    (ii) Sectional plan         **(15 Marks)**

2 a. An ISHB 400@774 N/m in lower storey of a building is connected to ISHB 350@674 N/m of upper storey. The thickness of bearing plate is 34 mm. The thickness of splice plate is 8 mm. Use suitable filler plate for top column 6 numbers of 16 mm diameter ordinary bolts are provided for connecting each of column flange with splice plate for lower storey column and 6 numbers of 16 mm bolts are provided for connecting each of column flange with splice and filler plate for upper storey column and 2 bolts for connecting only flange and filler plate. Assume pitch of bolts as 60 mm.
    Draw to a suitable scale: (i) Elevation    (ii) Sectional plan         **(15 Marks)**

   b. Following are the details of gusseted base.
    (i)     Built up column: 2-ISWB-400 at a spacing of 325 mm between webs.
    (ii)    The size of base plate: 600 mm × 750 mm
    (iii)   Thickness of base plate: 28 mm
    (iv)   Gusset angles ISA 150 × 100 × 12 with longer leg connected to gusset plate.
    (v)    Thickness of gusset plate 12 mm.
    (vi)   16 bolts of 20 mm dia connect gusset angles to gusset plate. 16 bolts of 20 mm dia connect gusset angles to the column.
    (vii)   Anchor bolts 20 mm $\phi$-4 numbers

   Draw to a suitable scale.
   (i) Elevation showing flanges of column.                      **(08 Marks)**
   (ii) Sectional plan.                                    **(07 Marks)**

## PART – B

3 Design the top Chord member and bottom chord member and the diagonal member DE of the roof truss shown in Fig.Q3. The design forces (factored) are given in table. Also design the joint 'A' using 16 mm dia bolts of class 4.6 bolts.
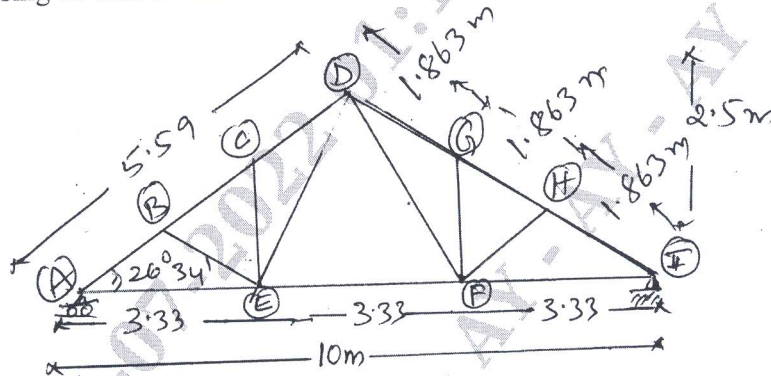


Fig.Q3

| Member | Factored Design Force | |
|---|---|---|
| | Comp (kN) | Tension (kN) |
| Top chord member | 54.25 | 34.42 |
| Bottom chord member | 28.26 | 48.31 |
| Diagonal member (DE) | 14.35 | 19.24 |
| Member AB | 54.25 | 34.42 |
| Member AE | 28.26 | 48.31 |

(40 Marks)

Draw a suitable scale:
(i) Elevation of the truss (cut section showing more than half)
(ii) Details of joint 'A'. (30 Marks)

4 Design of gantry girder to an industrial shed to support an electric overhead travelling crane using the following data:
Crane capacity = 200 kN
Weight of crab (trolley) = 60 kN
Weight of crane girder (excluding trolley) = 260 kN
Span of crane girder between rails = 18 m
Minimum approach for crane hook = 1.2 m
Wheel base = 3.2 m
Span of gantry girder = 7 m
Mass rail section = 300 N/m
Height rail section = 75 mm
Yield stress $f_y$ = 250 N/mm$^2$ (35 Marks)

Draw to a suitable scale.
(i) Front view (14 Marks)
(ii) Top view (14 Marks)
(iii) Section of gantry girder to an exchanged scale. (07 Marks)

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