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10CV82

Eighth Semester B.E. Degree Examination, July/August 2021
Design and Drawing of Steel Structures

Time: 4 hrs.   Max. Marks: 100

Note: 1. *Answer any ONE question each from PART – A and PART - B.*
2. *Use of IS-800-2007 and Steel tables are permitted.*
3. *Missing data if any may suitably assumed*

PART – A

1   a.   Two secondary beams ISLB 400@569N/m and ISLB 300@ 433.6N/m are connected to the web of main beam ISMB 600@1210N/m. Size of cleat angle ISA 90×90×8mm. Top flanges of all beams at same level. Provide :
3-20mm bolts for angle and ISLB300
4-20mm bolts for angle and ISLB 400
3-24mm bolts per angle for main beam connection.
Adopt pitch = 60mm and edge distance = 35mm. Draw to a suitable scale.
   i)   Section a elevation showing cross section of each secondary beam
   ii) Cross section of main beam showing connection secondary beam with the secondary beams.
   iii) Sectional plan.   **(18 Marks)**

   b.   A beam ISMB 500@ 852.5N/m is connected to the web of column ISHB 300@618N/m by stiffened seated connection. Size of seat plate 200mm × 90mm × 18mm. Size of stiffener plate 90mm × 180mm × 12mm, the width of which is reduced to 50mm at bottom. 10mm fillet weld is to connected seat plate and stiffener plate to column in the double angle shape. Seat plate is connected to bottom flange of beam using 5mm tack welds. A clip angle ISA100× 100 × 6mm of length equal to 120mm and welded alround it edges by 4mm weld, is provided to connect top flange of beam to web of column. Draw to a suitable scale :
   i)   Sectional elevation
   ii) Side view.   **(12 Marks)**

2   a.   A built up column of size 300mm × 300mm is comprising of 4 ISA 100 × 100 × 8mm at corners (Toe to Toe). The battens are to be provided along all four sides of column at a spacing of 850mm C/C. The size of intermediate battens – 300 × 200 × 6mm and end battens -300 × 250 × 6mm. 3 nos of M_{20} bolts are required to connect battens with the components of column. Adopt suitable pitch and draw :
i) Elevation   ii) Sectional plan.   **(10 Marks)**

   b.   A gusseted base is to be detailed for a column ISHB 450@ 855.4N/m built up with one cover plate 300mm × 16mm on each flange.size of base plate 800mm × 600mm × 40mm. The gusset angle – 2 nos ISA 150mm × 115mm × 15mm with long leg connected to gusset plate. Thickness of gusset plate – 16mm, provided at each face of column. 16nos. of M_{24} bolts are provided in two vertical rows to connect guset plate with column same nos of bolts are provided to connect Gusset angle with gusset plate. 6 nos of M_{20} counter sunk bolts are required to connect gusset angles to base plate. Web cleat angle 2 nos ISA 75 × 75 × 8mm with 2nos. of 20mm diameter bolt on each leg. Anchor bolts – 4 nos. of diameter 25mm at corners.
   Draw to a suitable scale :
   i)   Elevation
   ii) Side view
   iii) Sectional plan.   **(20 Marks)**

3 a. A gussetted base is to be detailed for column ISHB 450 @ 872 N/m is built-up with one cover plate of section 300×12 mm on each side of flange of column. The size of base plate of section $600 \times 800 \times 20$ mm, the gusset angles of ISA $150 \times 150 \times 10$ mm are provided on each side of column flange. The gusset plates are 10 mm thick. One plate on each side is provided with 12 numbers of 18 mm diameter bolts in two vertical rows connecting column flanges, cover plate, gusset plate and gusset angles. Similarly 12 numbers of bolts of 18 mm diameter are provided in two horizontal rows connecting column flanges, cover plate, gusset plate and gusset angle. Totally there are 20 numbers of bolts on each flange of column with 4 numbers of bolts common to horizontal and vertical rows of bolts four numbers of anchor bolts of 20 mm diameter are provided to anchor the column to pedestal.

Draw to suitable scale:

(i) Plan

(ii) Elevation. **(15 Marks)**

b. A built-up column made up of 2 ISMC 350 @ 42 W/m are placed back to back at a distance of 200 mm between webs. These components are connected by battons of 60 ISF 10 mm (ISF 60 mm width and 10 mm thickness) placed 300 mm c/c connected to flanges of ISMC. Length of each batton is 340 mm. 6 mm fillet weld for a length of 200 mm is used to connect the batton at each end.

Draw to suitable scale:

(i) Plan

(ii) Front elevation

(15 Marks)

PART – B

4 Design a roof truss in figure shown below Fig Q4 for the magnitude and nature of forces given below:

Top chord members – 135kN compression

Bottom tie members – 110 kN tension

Interior members – 75kN tension and 60kN compression

Adopt M_{20} black bolts of grade 4.6. Also design bearing plat and anchor bolts for a pull of 60kN to connect the truss to an RCC column 300mm $\times$ 300mm of concrete grade M_{20}.

Draw to suitable scale. **(40 Marks)**

    i) Elevation of truss greater than half space **(16 Marks)**

    ii) Enlarged view of support section and joint **(07 Marks)**

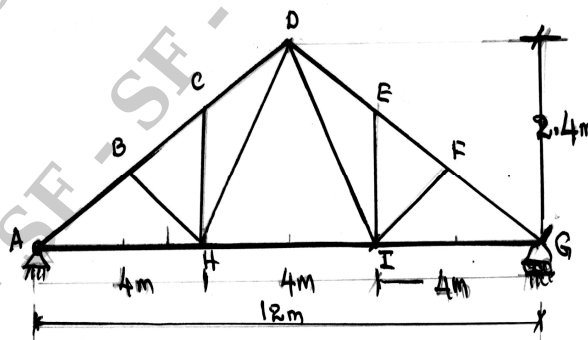   iii) Enlarged view of apex joint of truss. **(07 Marks)**

Fig Q4

5 Design a crane gantry girder using a ISWB section and a channel section with its web attached to top flange of I section and its flange down, for the following data:

span of crane girder – 18m

Span of gantry girder – 6.0m

Capacity of electrically operated crane – 200kN

Self weight of crane beams excluding crab – 200kN

Weight of crab – 50kN

Wheel base distance – 3.2m

Minimum hook approach – 1.0m

Self weight of rail – 0.3kN/m

Height of rail – 75mm

Height of Gantry girder limited to 560mm (maximum) **(40 Marks)**

Draw to a suitable scale

    i)   Cross section of Gantry girder and its attachment to column and bracket **(12 Marks)**

    ii) Plan details of layout of Gantry girder crane girder and gantry column **(10 Marks)**

    iii) side elevation 2 gantry column. **(08 Marks)**

6 Design a simply supported gantry girder to support an electrically operated crane, for the following data:

    i)   Span of crane girder = 25 m

    ii)   Span of gantry girder = 8 m

    iii) Capacity of crane = 200 kN

    iv) Self weight of crane = 150 kN [Excluding crab]

    v)   Weight of crab = 75 kN

    vi) Wheel base distance = 3.5 m

    vii) Minimum hook approach = 1.00 m

    viii) Self weight of rail = 0.30 kN/m

    ix) Height of rail = 75 mm **(40 Marks)**

Draw to suitable scale

    a.   The c/s of gantry girder and its attachment to supporting column of the bracket

    b.   Plan details

    c.   Side elevation **(30 Marks)**

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