

# CBCS SCHEME

15CV62

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## Sixth Semester B.E. Degree Examination, Aug./Sept.2020 Design of Steel Structural Elements

Time: 3 hrs.

Max. Marks: 80

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of IS-800-2007, SP(6)-1 or steel table is permitted.

### Module-1

- 1 a. What are the advantages and disadvantages of steel structures? (08 Marks)  
b. Explain limit state of strength and limit state of serviceability. (08 Marks)

OR

- 2 a. State upper bound, lower bound and uniqueness theorems. (06 Marks)  
b. A propped cantilever ABCD is loaded as shown in Fig.Q.2(b). Find the collapse load if the beam is of uniform cross section. (10 Marks)

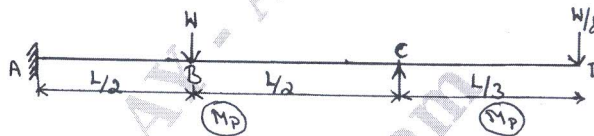


Fig.Q.2(b)

### Module-2

- 3 a. Explain the phenomenon of load transfer in high strength friction grip bolts. (06 Marks)  
b. A double cover butt joint is used to connect two flats 200 ISF 10 with 8mm cover plates. The two plates are connected by 9 bolts in chain bolting at a pitch of 60mm and edge distance of 40mm. The bolts are arranged in 3 rows with 3 bolts in each row as shown in the Fig.Q.3(b). Determine the strength and efficiency of the joint. The diameter of the bolts used is 20mm. Assume grade of bolt as 4.6. (Assume both thread and shank to interfere the shear plane). (10 Marks)

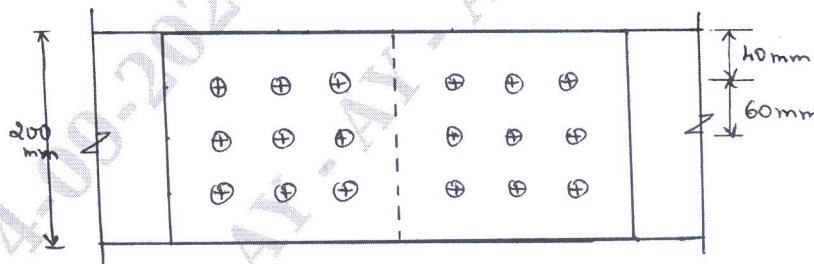


Fig.Q.3(b)

OR

- 4 a. Write the advantages of welded connections over bolted connections. (06 Marks)  
b. A tie member consisting of an ISA 80 × 50 × 8mm (Fe 410 grade steel) is welded to a 12mm thick gusset plate at site. Considering the size of weld as 6mm, find the length of weld required to transmit load equal to design strength of the member. (10 Marks)

**Module-3**

- 5 a. Determine the design strength of ISHB300@ 0.588kN/m, used as stanchion. Effective length of stanchion is 3.0m. (04 Marks)
- b. Design a compression member of a roof truss to carry an axial load of 150kN. Design the member using a single unequal angle and the corresponding connections to a gusset plate using 20mm diameter bolts of grade 4.6 grade, connecting the longer legs to the gusset plate of 8mm thick. Take effective length of the member as 2.5m. (12 Marks)

**OR**

- 6 The axial load on a steel column is 2000kN. The column of length 5m is effectively held in position at both ends and restrained in direction at the end. Design a suitable built-up column made of 2 I-sections spaced apart, adopting a single lacing system. Consider permissible stress ( $f_{cd}$ ) = 180N/mm<sup>2</sup>. (16 Marks)

**Module-4**

- 7 a. Explain: i) Lug angles ii) Shear Lag. (06 Marks)
- b. Determine the design tensile strength of the plate 200 × 10mm with bolts as shown in Fig.Q.7(b). The yield and ultimate strengths of steel are 250MPa and 410MPa respectively. The diameter of bolt used is 20mm. (10 Marks)

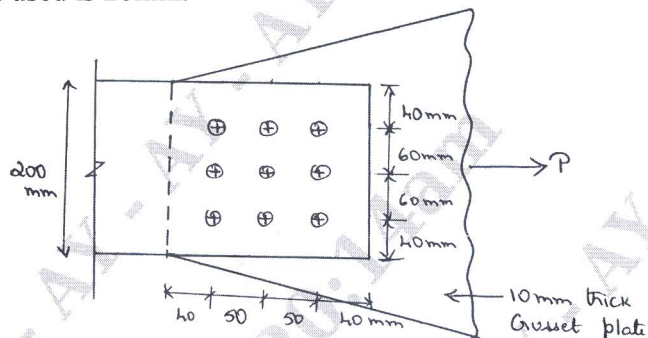


Fig.Q.7(b)

**OR**

- 8 a. With the help of neat sketches, explain the different types of column bases. (06 Marks)
- b. Design a suitable slab base for a column carrying an axial load of 800kN. The section of the column is built up by ISHB250 @ 54.7 kg/m and 2 plates 300mm × 10mm one on each flange of the joint section. The bearing capacity of the soil is 250 kN/m<sup>2</sup>. Consider grade of concrete as M20, thickness of weld as 8mm and bearing strength of concrete as 9N/mm<sup>2</sup>. (10 Marks)

**Module-5**

- 9 a. Explain the factors affecting the lateral stability of beams. (08 Marks)
- b. Calculate the moment and shear capacity of a laterally restrained beam ISLB350 @ 0.486kN/m. (08 Marks)

**OR**

- 10 a. Write a note on the ways to connect a beam and a column. (04 Marks)
- b. Check the adequacy of a laterally restrained cantilever beam ISMB 550@ 1.037 kN/m to withstand a moment of 562.5 kN-m and shear force of 225kN, performing all checks necessary for design of a beam. (12 Marks)

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