

**Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025**  
**Design of Steel Structural Elements**

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
 2. Use of IS800 : 2007, steel table is permitted.*

**Module-1**

- 1 a. Explain the failure criteria of steel. (10 Marks)
- b. Explain briefly the classifications of cross sections. (10 Marks)

OR

- 2 a. Calculate the shape factor for the triangular section. (10 Marks)
- b. Calculate the plastic moment capacity required for continuous beam subjected to working load as shown in Fig.Q.2(b). Take load factor = 1.5. (10 Marks)

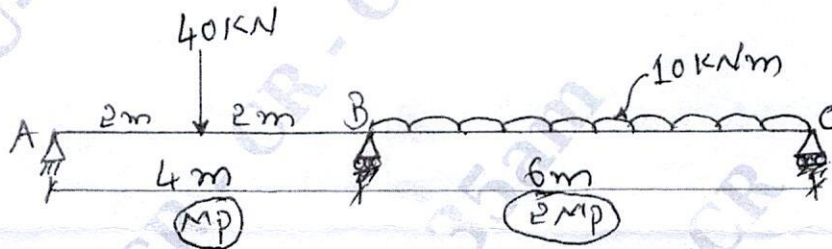


Fig.Q.2(b)

**Module-2**

- 3 a. Explain with neat sketches various modes of failure of bolted connections. (10 Marks)
- b. Design a bolted connection for a lap joint between plates of size 100 × 16 mm and 100 × 10 mm to transmit a factored load of 100 kN using single row of bolts of grade 4.6 and grade 410 plate. Assume  $e = 30$  mm and diameter of bolt = 16 mm. (10 Marks)

OR **CMRIT LIBRARY**  
 BANGALORE - 560 037

- 4 a. Explain briefly the common defects in welding with neat sketches. (10 Marks)
- b. Design a fillet weld for the angle section ISA 80 mm × 50 mm × 8 mm. welded to a 12 mm thick gusset plate at site. Assume that welding is done on 3 sides. Take Fe 410 grade steel. (10 Marks)

**Module-3**

- 5 a. Explain the possible modes of failure of axially loaded columns. (10 Marks)
- b. Determine the design axial load on the column section ISMB 450 @ 710.2 N/m, length of column is 4 m and it is hinged at both ends. Assume  $f_y = 250$  N/mm<sup>2</sup>. (10 Marks)

OR

- 6 Design a double angle discontinuous strut to carry a factored load of 135 kN, resulting from combination of wind load. The length of the strut is 3 m between intersections. The two angles are placed back to back (with two long legs connected) and are tack bolted. Use Fe 410 grade steel.
- Angles are placed on the opposite sides of a 12 mm gusset plate.
  - Angles are placed on the same sides of a 12 mm gusset plate.

(20 Marks)

**Module-4**

- 7 a. Explain the factors affecting the strength of tension members. (10 Marks)
- b. Determine the tensile strength of the plate 150 mm × 10 mm connected to 12 mm thick gusset plate using 6 numbers of M16 bolts in two rows. 3 number of bolts in each row with pitch = 60 mm, end distance = 30 mm, gauge distance = 90 mm. Use property class 4.6 bolts,  $f_u = 410 \text{ N/mm}^2$ . (10 Marks)

OR

- 8 a. Explain lug angles and column splices. (10 Marks)
- b. Design a slab base for a column ISHB 300 @ 577 N/m carrying an axial factored load of 1000 kN. M20 concrete is used for the foundation. Provide welded connection between column and base plate. (10 Marks)

**Module-5**

- 9 a. Explain briefly the design steps followed while designing laterally supported beam as per IS 800 : 2007. (10 Marks)
- b. Determine the design bending strength of a beam ISMB 300 @ 433.6 N/m. Use Fe 410 grade steel. (10 Marks)

OR

- 10 Design a cantilever beam built into a concrete wall. It supports a dead load (including self weight) of 18 kN/m and a live load of 12 kN/m. The effective span of beam is 4.5 m. Beam is laterally supported. Take  $f_y = 250 \text{ N/mm}^2$ ,  $E = 2 \times 10^5 \text{ N/mm}^2$ . Also check for web buckling web crippling. (20 Marks)

\*\*\*\*\*