B. E. Sixth Semester (Civil Engineering) (C.B.S.)

# Steel Structures

P. Pages : 3 **NKT/KS/17/7375**

Time : Four Hours * 0 4 8 1 * Max. Marks : 80

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Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Assume suitable data whenever necessary.
7. Illustrate your answers whenever necessary with the help of neat sketches.
8. Use of non programmable calculator is permitted.
9. Use of structural steel table and IS 800: 2007 is permitted.

**1.** a) Determine the plastic section moduli and the plastic moment capacity of the channel section shown in Fig. 1 about x-x axis. Assume $fy = 250\,N/mm^2$. **7**

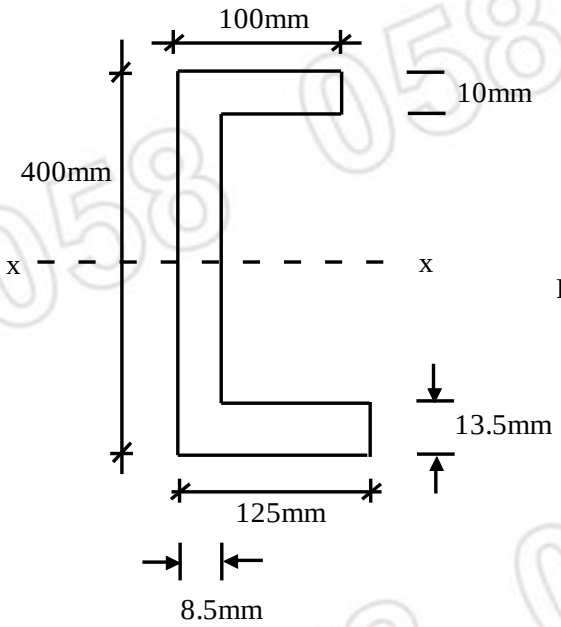


Fig. 1

b) A tension member is subjected to a factored load of 275kN. Design the section using two angles provided on same side of gusset plate. Length of the member is 2.5m. Provide bolted connection. **13**

**OR**

**2.** a) Find the value of W at collapse for the fixed beam of uniform section as shown in Fig:2. **7**

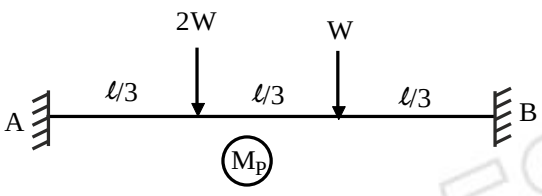


Fig. 2

b) Design a single angle discontinuous strut 3m long between intersections. The service load acting on the member is 80kN. Provide welded connection. Use E250 (Fe410W) B grade steel. **13**

**3.** a) A tie FLAT 100mm×15mm is welded to another plate as shown in Fig:3. It is subjected to a factored pull of 300kN. Find the minimum overlap required if 8mm fillet welds are used. **8**

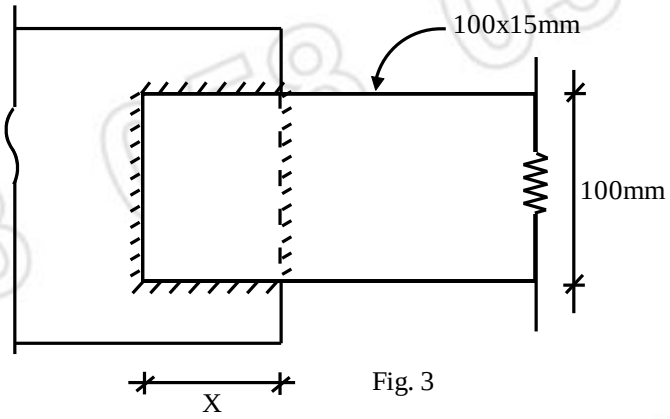


Fig. 3

b) A working load of 150kN is applied to a bracket plate at an eccentricity of 300mm. The bolts are arranged as shown in Fig: 4. The thickness of the bracket plate is 12.0mm. Investigate the safety of the design.

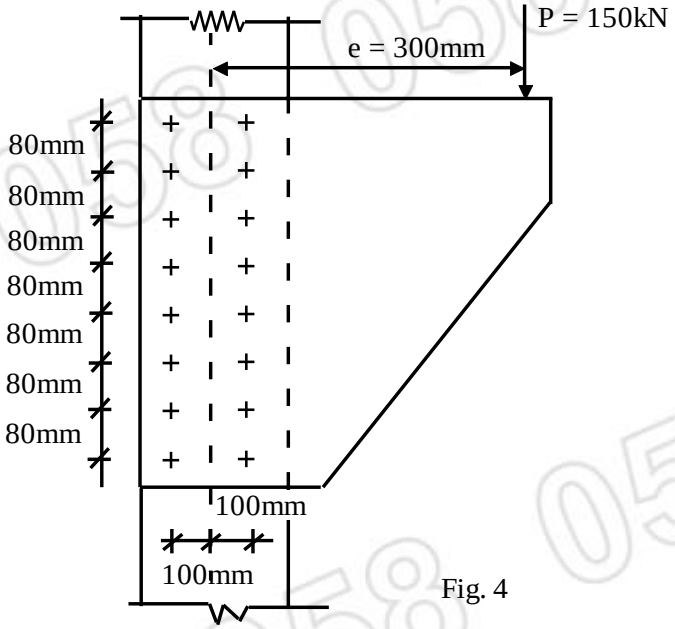


Fig. 4

**OR**

**4.** a) Design a welded stiffened seat angle connection to connect a beam ISMB 400 to flange of a column ISHB 200. The reaction transferred from the beam is 250kN. Assume E250 (Fe410W) C grade steel. **10**

b) Design a splice connection for an ISMB 400 to transfer a factored bending moment of 120kNm and factored shear of 80kN. Use ordinary bolts of grade 4.6. and E 300 (Fe 440) grade steel. **10**

**5.** A simply supported beam of clear span 5.5m is supported on 250mm wide end bearings. The beam has to carry a service udl of 45kN/m excluding its own weight. Design the beam if it is laterally supported. **20**

**OR**

**6.** A girder of span 24m is carrying a superimposed service load of 60kN/m throughout its length and a concentrated load of 400kN acting at its mid span. The compression flange of the girder is restricted from moving laterally. Design the girder if only 8mm, 10mm and 12mm thick plates are available. Provide welded connection. **20**

**7.** Design a built-up column using two channels arranged face to face to resist a service load of 800kN. The length of the column is 8.0m which is effectively held in position at both ends but not restrained against rotation at one end. Use single lacing system and bolted joint. **20**

**OR**

**8.** Design an I section beam-column of length 4m as a ground floor column in a multistorey building. The frame is moment resisting in-plane and pinned out of plane, with diagonal bracing provided in both directions. The column is subjected to major axis (z-z) bending due to horizontal forces and minar axis (y-y) bending due to eccentricity loads. Take factored axial load = 750kN, **20**

factored moments: at the top of column: $M_z = 150\text{kNm}$, $M_y = 100\text{kNm}$ at the base of column: $M_z = -150\text{kNm}$, $M_y = 0$ Use Fe410 grade steel.

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