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Paper Code &amp; Roll No. to be filled in your Answer Book

Roll No. : 

Even Semester Examination-2017

**B.Tech. (Semester-VI)****DESIGN OF STEEL ELEMENTS****(TCE-602)****Time : 3 Hours****Maximum Marks: 100**

**Note :** Attempt all questions, the marks assigned to each question is indicated at question itself.

**Q1.** Attempt any **FOUR** questions **[4 x 5]**

(i) Define :

a) pitch,

b) edge distance in bolted connections,

c) end distance in bolted connections,

d) gauges

f) tacking bolt

- (ii) Define types of bolt & types of bolt joint.
- (iii) State advantages of steel structures.
- (iv) State disadvantages of steel structures.
- (v) State mechanical properties of structural steel.
- (vi) State modes of failure of a bolted connection.

**Q2.** Attempt any **FOUR** questions **[4 x 5]**

- (i) What are the reasons, the riveted joints have lost their importance?
- (ii) What are prying forces?
- (iii) Why are the end returns provided in fillet welds?
- (iv) What is inelastic buckling?
- (v) Differentiate between the bending and buckling of beam.
- (vi) In what sense column caps are similar to column base plates?

**Q3.** Attempt any **TWO** questions **[2x 5]**

- (i) Design a built- up column 9 m long to carry a factored axial compressive load 1100kn. The

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column is restrained in position but not in direction at both the ends. Design the column with connecting system as battens with bolted connections. Use two channel sections back to back. use steel of grade Fe 410

- (ii) Calculate the strength of a discontinuous strut of length 3.2m. the strut consists of two unequal angles 100mm X 75mm X 8mm ( $f_y = 250 \text{ N/mm}^2$ ), with long legs connected and placed:
- (a) On the opposite side of a gusset plate
  - (b) On the Same side of a gusset plate
- (iii) Two ISF section 200mm x 10mm each and 1.5m long are to be joined to make a member length 3m. Design a butt joint with the bolts arranged in the diamond pattern. The flats are supposed to carry a factored tensile force of 450kn. Steel is of grade Fe 410. 20mm diameter bolts of grade 4.6 are used to make the connection. Also determine the net tensile strength of the main plate and cover plates.

Q4. Attempt any **TWO** questions [2x 5]

(i) A boiler shell is made up of 14mm thick Fe415 plates. If the joint is double bolted Lap joint with M16 bolts of grade 4.6 at distance of 50mm. Determine the design strength of the joint per pitch width.

(ii) Design a laterally supported beam of effective span 6 m for the following data.

Grade of steel: Fe410

Maximum bending moment  $M = 150 \text{ kNm}$

Maximum shear force  $V = 201 \text{ kN}$

Check for deflection is not required.

(iii) A built-up column 10 m long to carry factored axial load of 1080kN. The column is restrained in position but not in direction at both ends. Design single lacing system with bolted connection for two channels placed back to back. Assume steel of grade Fe 410 and Bolts of grade 4.6 and use ISMC 300 @ 351.2 N/m

For steel of grade Fe 410:  $f_u = 410\text{MPa}$ ,  
 $f_y = 250\text{MPa}$

For bolts of grade 406:  $f_{ub} = 400\text{MPa}$ ,

$K_b = 1$

Q5. Attempt any **TWO** questions [2x 5]

(i) Determine the design bending strength of ISLB 350@ 486 N/m considering the beam to be laterally supported. The design shear force  $V$  is less than the design shear strength. The unsupported length of the beam is 3 m. Assume steel of grade Fe 410.

(ii) A simply supported steel joist of 4 m effective span is laterally supported throughout. It carries a total uniformly distributed load of 40 kN (inclusive of self weight). Design an appropriate section using steel of grade Fe 410.

For steel of grade Fe 410:  $f_{yw} = 250\text{MPa}$ ,  
 $f_y = 250\text{MPa}$

(iii) A single unequal angle ISA 90x60x6 mm is connected to a 10mm gusset plates at the ends with 5 numbers of 16mm bolts to transfer tension. Determine the tensile strength of the angle,

(a) If the gusset is connected to a 90mm Leg

(b) If the gusset is connected to a 60mm Leg