

Total No. of printed pages = 7

END SEMESTER EXAMINATION - 2020

Subject Code : CT - 602

DESIGN OF STEEL STRUCTURE

Full Marks - 70

Time - Three hours

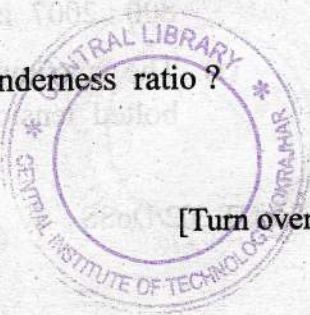
The figures in the margin indicate full marks for the questions.

PART - A

Marks - 25

1. Answer the following questions : $1 \times 10 = 10$
- (a) Define rigid connection.
 - (b) Define pitch and gauge of a bolted connection.
 - (c) List some of the tension members used in buildings and bridges.
 - (d) Write the minimum edge distance in member with rolled edge.
 - (e) What is meant by slenderness ratio?

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- (f) What is buckling class of a solid section when the buckling is about z - z axis ?
- (g) List the different modes of failure of a bolted connection.
- (h) What do you mean by special fillet weld ?
- (i) What is effective length of a column ?
- (j) List the four types of weld.

2. Fill in the blanks : 1×8=8

- (a) Minimum length of fillet weld should be _____ times the size of fillet weld.
- (b) As per IS 800 : 2007, the diameter of bolt hole can exceed the diameter of the bolt having diameter larger than 24 mm by _____.
- (c) The net tensile area of M16 bolt is _____.
- (d) Design strength due to yielding of gross section is computed using the formula _____.
- (e) The design compressive strength of an axially loaded compression member as per IS 800 : 2007 is based on _____.
- (f) The maximum transverse pitch allowed in bolted tension member is _____.

- (c) The minimum pitch distance in member is
- (i) 2.5 bolt diameter
 - (ii) 1.5 bolt diameter
 - (iii) 2.0 bolt diameter
 - (iv) 1.7 bolt diameter
- (d) The maximum longitudinal pitch allowed in bolted compression member is
- (i) 16 times thickness of plate or 200 mm
 - (ii) 100 mm plus 4 thickness of plate or 150 mm
 - (iii) 150 mm plus 4 thickness of plate or 150 mm
 - (iv) 16 times diameter of bolt or 200 mm
- (e) Which of the following is not a mode of failure in a tension member ?
- (i) gross section yielding
 - (ii) net section rupture
 - (iii) local buckling
 - (iv) block shear failure

(f) In case of staggered pitch, pitch may be increased by

- (i) 50%
- (ii) 20%
- (iii) 100%
- (iv) 30%

(g) Rivets are no longer used in steel construction because

- (i) they need pre heating
- (ii) they require larger crew
- (iii) of the high level of noise involved
- (iv) All of these.

PART - B

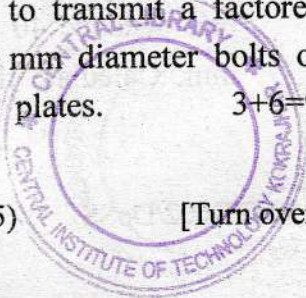
Marks - 45

4. Define black bolt and high strength bolts. How are the bolts graded? Discuss. Design a butt joint between two plates of size 100×12 mm thick and 100×16 mm thick so as to transmit a factored load of 150 kN using 16 mm diameter bolts of grade 4.6 and grade 410 plates. $3+6=9$

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(5)

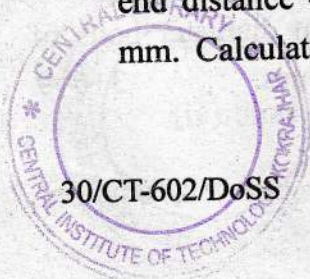
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5. The plates of 12 mm thick are connected by a double bolted butt joint with 24 mm diameter bolts. Calculate the efficiency of the joint assuming grade 4.6 bolts and Fe 410 plates. Differentiate between bolted connection and rivet connection. $6+3=9$

6. What do you mean by welding? Discuss the various types of welding with figures. What are the advantages and disadvantages of welding over bolting? A tie member of a truss consisting of an angle section ISA $100 \times 100 \times 8$ of Fe 410 grade, is welded to a gusset plate. Design a weld to transmit a load equal to the full strength of the member. Assume shop welding. $1+2+2+4=9$

7. Explain the different types of failure of a tension member. A steel plate of size 200×12 mm is used as a tension member in a roof truss. It is connected to a gusset plate by 6 numbers of 20 mm diameter bolts having pitch distance 55 mm, end distance 40 mm and gauge distance of 120 mm. Calculate the tensile strength of the plate. $3+6=9$



8. What do you mean by compression members ?
Determine the design axial load on the column section ISMB 350, given that the height of column is 3.3 m and that it is pin ended. Also assume the following :

$$f_y = 250 \text{ MPa}, f_u = 410 \text{ Mpa and } E = 2 \times 10^5 \text{ MPa.}$$

$$2+7=9$$

