Total No. of printed pages = 7

END SEMESTER EXAMINATION – 2019

Semester – 6th

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.

Instruction :

The question paper consists of two parts : PART–A and PART–B, both are compulsory.

PART – A

Marks – 25

1. Fill up the blanks : 1×8=8

   (a) According to IS 800, based on connection rigidity, joints are considered as ____.

   (b) Slot welding is used when two plates are placed ____.

   (c) As per IS 800 : 2007, the diameter of bolt holes can exceed the diameter of the bolt having diameter larger than 24 mm by ____.

[Turn over

(d) The ratio of net tensile area at threads to nominal shank of the area of bolt is taken in IS 1367 as ____.

(e) Design strength due to rupture of critical section is computed using the formula ____.

(f) The design compressive strength of an axially loaded compression member as per IS 800 : 2007 is based on ____.

(g) The maximum longitudinal pitch allowed in bolted tension member is ____.

(h) As per the code, the effective length of a column hinged at both ends is ____.

2. Choose the correct option : 1×9=9

(a) A vertical member primarily subjected to compression is called

(i) Principal rafter

(ii) beam

(iii) Strut

(iv) Stanchion

(b) Which of the following is correct ?

(i) Size of the hall = nominal diameter – clearance

(ii) Size of the hall = nominal diameter × clearance

(iii) Size of the hall = nominal diameter + clearance

(iv) Size of the hall = nominal diameter / clearance

(c) The failure mode in which an axially loaded compression member may fail is

(i) Local buckling

(ii) Squashing

(iii) Overall flexural buckling

(iv) All of these.

(d) The minimum edge distance in member with rolled edges is approximately

(i) 1.5 hole diameter

(ii) 1.7 hole diameter

(iii) 2 hole diameter

(iv) 1.7 bolt diameter

(e) 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.

(f) Using welding, we can obtain upto

(i) 75% efficiency

(ii) 85% efficiency

(iii) 95% efficiency

(iv) 100% efficiency

(g) The size of fillet weld is taken as

(i) side of the triangle of the fillet

(ii) throat of the fillet

(iii) size of plate

(iv) length of the fillet weld

(h) 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

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

(i) 50% (ii) 20%

(iii) 100% (iv) 30%

3. Write true or false : 1×8=8

(a) The members meeting at an angle can be welded using fillet welds only.

(b) The ratio of the effective throat of fillet weld to its size is less than 1.0.

(c) The diameter of bolt hole can exceed the diameter of the bolt by about 2–5 mm

(d) The vertical member primarily subjected to compression is called compression member.

(e) In property class 4.6 of bolts the numbers 4 and 6 indicate ultimate tensile stress of 400 MPa and yield stress 240 MPa.

(f) As per code, the effective length of a cantilever column is 2L, where L is length of the column.

(g) Groove welding is the type of welding used for connecting the member without eccentricity.

(h) HSFG bolts are more advantageous than black bolts.

PART – B

Marks – 45

4. Define lap and butt joints with figure. Design a butt joint between two plates of size 100 × 10 mm thick and 10 × 12 mm thick so as to transmit a factored load of 120 kN using 16 mm diameter bolts of grade 4.6 and grade 410 plates. 3+6=9

5. Define efficiency of a joint. The plates of a tank 10 mm thick are connected by a double bolted lap joint with 20 mm diameter bolts at 50 mm pitch. Calculate the efficiency of the joint assuming grade 4.6 bolts and Fe 415 plates. 2+7=9

6. Define groove and fillet welds with figures. What are the advantages and disadvantages of welding over bolting ? A tie member of a truss consisting of an angle section ISA 120 × 120 × 10 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. 2+2+5=9

7. Explain tension members with diagram. A steel plate of size 180 × 14 mm is used as a tension member in a roof truss. It is connected to a gusset plate by 6 numbers of 24 mm diameter bolts having pitch distance 55 mm, end distance 40 mm and gauge distance of 100 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 3.2m and that it is pin ended. Also assume the following :

f_y = 250 MPa

f_u = 410 MPa and

E = 2 × 10^5 MPa. 2+7=9