TCE-602 1100

# Even Semester Examination 2018-19

## B.Tech. (Civil Engineering) (SEMESTER-VI)

# DESIGN OF STEEL ELEMENT

**Time: 03:00 Hours** **Max Marks : 100**

**Note :** **All** questions are **compulsory**. Draw diagrams wherever necessary. **All** questions **carry equal** marks. **The Use of IS:800-2007 and Steel Table is permitted.**

1. Attempt **any four** parts of the following : [5×4=20]

   (A) List the mechanical properties of steel along with the factors that influence them.

   (B) Distinguish between working stress method & limit state method of design.

   (C) In class 4.6 bolt, what do the number 4 & 6 indicate?

   (D) Write short note on the block shear failure in plates.

   (E) Determine deign axial load on the column ISMB350. Given that height of column is 3.0 m and it is pin ended. Also assume: $f_y$ = 250 MPa , $f_u$ = 410 MPa , E = 2 x $10^5$ MPa.

   (F) List the different mode of failure of the tension members.

2. Attempt **any four** parts of the following : [5×4=20]

   (A) Write short note on the classification of cross section as per IS800-2007.

   (B) For a builtup I-section having flange 200 mm x 3 mm and web 300 mm x 1.5 mm. Calulate $Z_p$ , $M_p$ and shape factor.

   (C) Enlist the various types of stiffeners and their functions.

   (D) What are various the types of groove welds? Show with neat sketches.

(E) Explain:

(i) Flexural-Torsional buckling ,

(ii) Torsional Buckling,

(iii) local buckling

(F) Differentiate between web crippling and web buckling.

3. Attempt **any two** parts of the following : [10×2=20]

(A) A builtup laced column composed of two channel section (ISMC350) placed back to back at a spacing of 220 mm, carrying a factored axial load of 1400kN. The length of column is 10 m. the column may be assumed to have restrained in position but not in direction at both ends. Determine the following for the column.

(i) Check the adequacy of the builtup column (laced) for axial load capacity.

(ii) If single lacing system has to be design for the above column, then check the adequacy of the flats size 60ISF14 mm. also design the end connection using M20 bolts. Keep the inclination of the lacing member $45^0$ with the axis of the column

(B) A simply supported beam of 7 m span carrying a reinforced concrete floor capable of providing lateral restraint to the top compression flange. The total udl is made up of 100kN dead load including selfweight plus 150kN imposed load. In addition, the beam carries a point load of 100 kN at mid span (assume a stiff bearing length of 75 mm.) Check the following if the section of beam is ISMB550@1.037kN/m.

(i) Class of the section used.

(ii) Check the design capacity

(iii) Check for deflection

(iv) Check for web buckling at support

(C) Design an I-section purlin for a trussed roof from the following data.

Span of roof = 12 m ; Spacing of truss = 5 m ;

Spacing of purlins along the slope of roof truss = 2m

Slope of roof truss = 1V: 2H;

Wind load on roof surface normal to roof = 1000N/$m^2$;

Vertical load from roof sheets etc. = 200 N/$m^2$.

4. Attempt **any two** parts of the following : [10×2=20]

(A) Find Tension carrying capacity of single angle ISA 100x100x8 mm connected to gusset plate by means of three bolts of 22 mm dia at 80 mm pitch in one line. Assuming end distance is 40 mm. take fy = 250 MPa and fu = 410 MPa.

(B) The section of a plate girder consists of 1200x12 mm web plate and 450x35 mm flange plate. This plate girder is subjected to a factored moment = 4275 kN m. and S.F. = 877.5 kN. for plate girder section determine the following

i) Moment Capacity Check

ii) Shear resistance of the web using post critical method

iii) Suitability of 220x12 mm flat as stiffeners at support

(C) Calculate the Maximum Load which has to be carried by a bracket bolted to the flange plate of a steel column as shown in figure-1. The diameter of the bolts is 16 mm and Grade 4.6 and Grade of plate is 410. Assuming threads in shear plane

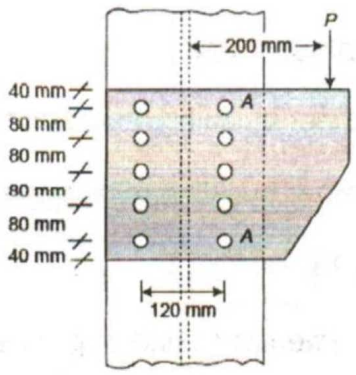


Fig-1

5. Attempt **any two** parts of the following : [10×2=20]

(A) A tie member of roof truss consists of 2ISA 100x75x10 mm. The angles are welded on opposite side of 12 mm thick gusset plate with long leg .It is subjected to a working pull of 300 kN. Design & Detail the welded connection. Assume connection is made in the workshop.

(B) Calculate the following for slab base of a column ISHB250 supporting a factored axial load of 500 kN and factored moment of 45 kN-m. The base plate is to rest on concrete pedestal of M25 grade.

i) Size of the base plate assuming the one side of slab base is 540 mm.

ii) Thickness of the slab base (considering the one side bending only)

iii) Draw the neat sketch (all view) for the above base.

(C) A non-sway column in a building frame with flexible joint is 4 m high and subjected to the following load and moment :

Factored axial load = 500 kN,

Factored moment $M_z$: at top of column = 27.0 kN-m and

at bottom of column = 45 kN-m

Check the adequacy of the Column section ISHB250 as per IS: 800-2007. Assuming

$f_y$ = 250 MPa. Take effective length of the column as 0.8L along both the axes. Give the solution as per the following steps

i) Cross-section classification

ii) Check for Local Capacity

iii) Check for member buckling resistance in compression

iv) Check for member buckling resistance in bending

[$M_{cr}$ = 554 kN-m]

v) Check for overall member buckling resistance for combined and axial compression