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B.Tech 4th Semester Examination

Design of Steel Structures-I

CE-4002

Time : 3 Hours   **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/ continuation sheet will be issued.

Note :   The question paper consists of five sections A, B, C, D and E. A candidate is required to attempt five questions in all selecting one question from each section A, B, C, D and all parts of section E. Use of IS codes IS 800:2007 is allowed.

SECTION - A

1. Two plates each 12 mm thick are to be jointed using 22 mm diameter bolts of grade 4.6 using (i) lap joint, (ii) single cover butt joint using cover plate 10 mm thick and (iii) double cover butt joint using cover plates each 8 mm thick. Determine the strength of a 22 mm diameter bolt of grade 4.6 in each case.   **(20)**

2. A tie member of Fe 410 grade steel consists of an ISA 75 mm × 50 mm × 8 mm. It is welded to 10 mm thick gusset plate at site using fillet weld. Design the welded connection to transmit a load equal to the yield strength of the tie member   **(20)**

SECTION - B

3. A tension member consisting of single unequal angle 100 × 75 × 8 mm is connected to a 12 mm thick gusset plate at the ends with 6 number 20 mm diameter bolts in one row. Determine the design tensile strength of the angle if the gusset is connected to the 100 mm leg. The yield strength and ultimate strength of the steel used are 250 MPa and 400 MPa. The diameter of the bolts used is 20 mm. The pitch and the edge distance may be taken as 50 mm and 30 mm respectively.   **(20)**

4. Design a built up column consisting of two channels placed back to back to carry a factored load of 1100 kN. The column is 9.0 m long and is pinned at both ends. Assume steel of grade FE 410.   **(20)**

SECTION - C

5. Enumerate the step by step procedure to design a laterally supported steel beam using limit state method.   **(20)**

6. A simply supported steel beam having an effective span of 4.5 m is supported laterally throughout. The beam carries a distributed load of 38 kN inclusive of self-weight. Design an appropriate section for the beam using steel of grade Fe 410.   **(20)**

SECTION - D

7. Design a slab base for a column ISMB 400 subjected to factored axial load of 1800 kN. The load is to be transmitted to the base plate by direct bearing.   **(20)**

8. A simply supported plate girder having an effective span of 24 m carries a superimposed load of 38kN/m. Design a welded plate girder without bearing and transverse stiffeners. Use steel of grade Fe 410. **(20)**

SECTION - E

9. Briefly answer the following questions:

   (a) How is structural steel classified? Draw a typical stress-strain curve for the mild steel and indicate its salient features.

   (b) Why the welded connections are preferred over riveted connections?

   (c) Enumerate the advantages of high strength bolts.

   (d) What are the two limit states for the steel design?

   (e) Explain the three prominent failure modes of a tension member.

   (f) Define slenderness ratio and enumerate steps to determine the same.

   (g) What do you understand by web buckling?

   (h) Explain plastic moment of a rolled I-section.

   (i) What do you understand by pre-buckling behaviour of plate girder?

   (j) In the design of gantry girders, what are the loads which need to be considered?

   (2×10=20)