



## T.E. (Civil) (Semester – I) Examination, 2010

## STRUCTURAL DESIGN – I

(2008 Course) (New)

Time : 4 Hours

Max. Marks : 100

**Instructions :** 1) Attempt Q. 1 or Q. 2, Q. 3 or Q. 4 from Section I and Q. 5 or Q. 6, Q. 7 or Q. 8 from Section II.

2) Answers to the **two** Sections should be written in **separate** answer books.

3) **Neat** diagram must be drawn **wherever** necessary.

4) Figure to the **right** indicates **full** marks.

5) Assume suitable data, if **necessary** and **clearly** state.

6) Use of cell phone is **prohibited** in the examination hall.

7) Use of electronic pocket calculator IS : 800-2007 and steel table is **allowed**.

## SECTION – I

1. a) Explain in brief design philosophy of limit state design for strength and serviceability. 10
- b) Design a tension member using double unequal angle sections back to back on opposite faces of 10 mm thick gusset plate if it carries an axial factored load of 425 kN using 20 mm black bolt. Assume Fe-415 grade of steel. Draw the design sketch. 15

OR

2. a) Differentiate between bolted and welded connection. 7
- b) Explain the classification of cross section and hence find class of ISMB 300@44.2 kg/m. 8
- c) A single angle ISA 90×60×6@6.8 kg/m is connected to 8 mm thick gusset plate at the ends with 4 nos. of 16 mm bolts to transfer tension. Determine the design tensile strength of angle section if the gusset plate is connected to the longer leg. 10



3. a) Determine the load carrying capacity of a compound column consisting of ISMB 400@72.4 kg/m with one cover plate of 300 mm×20 mm on each flange and having a length of 5 m. One end of the column is fixed and other end is pinned. Assume  $f_y = 250$  Mpa. 10
- b) Design a built-up column 10 m long to carry a factored load of 1100 kN. The column is restrained in position but not in direction at both ends. Design the column by using two channels back to back and single lacing with bolted connection. Draw the design sketches. 15

OR

4. a) Design a single angle strut connected to the gusset plate to carry an axial compression of 200 kN. The length of the strut between centre to centre intersections is 3 m. Design welded connection of the joint. 10
- b) Design a gusseted base for a built-up column ISHB 350@ 67.4 kg/m with two plates 450 mm×22 mm carrying an axial factored load of 3000 kN. The column is to be supported on concrete pedestal of M 20 grade. Draw the design sketches. 15

## SECTION – II

5. a) A simply supported beam of effective span 4 m carries a factored point load of 350 kN at mid span. The section is laterally supported throughout the span. Design the cross section using I-section. 10
- b) Design a column of building frame with an effective length 3.2 m subjected to a factored axial load 500 kN and factored bending moment 45 kNm. Check for section strength only. 15

OR

6. a) Design a suitable I-section for a simply supported beam of span 5 m carrying a dead load of 20 kN/m and imposed load of 40 kN/m. The beam is laterally unsupported throughout the span. Take  $f_y = 250$  Mpa. 15
- b) Design a moment resistance base for a ISHB 250 @ 54.7 kg/m column to carry a factored load of 600 kN and factored bending moment 50 kNm. 10



7. A plate girder is subjected to a maximum factored moment of 4000 kNm and a factor shear force of 600 kN. Find the preliminary sections for the following conditions and cross section.

- a) Girder without any stiffener,
- b) Girder with end stiffeners only,
- c) Girder with end as well as intermediate transverse stiffeners.

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OR

8. A truss as shown in Fig. 8 is used for an industrial building situated in Pune. The truss is covered with G I sheet. Calculate panel point dead load, live load and wind load. Design the members  $L_0L_1$ ,  $L_0U_1$  and  $U_1L_1$  and draw the design details. Assume  $k_1 = 1$ ,  $k_2 = 0.98$ ,  $k_3 = 1$ ,  $(c_{pe} - c_{pi}) = -0.8$ .

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