Total No. of Questions : 6]

SEAT No. : ☐

P4186

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M.E. (Civil Structures)

PLASTIC METHOD FOR ANALYSIS AND DESIGN OF STEEL STRUCTURES

(2008 Pattern) (Elective - II) (Semester - I)

Time : 4 Hour]

[Max. Marks : 100

Instructions to the candidates:

1) *Answer any two questions from each section.*

2) *Answer to the TWO Sections should be written in separate answer books.*

3) *Neal sketches must be drawn wherever necessary.*

4) *Figures to the right indicate full marks.*

5) *Use of non-programmable calculator, IS: 800-2007 and steel table is allowed.*

6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Explain Complete. Over complete & Partial collapse at structure. **[5]**

b) A simply supported beam of equal I - section is subjected to bending moment. Find the shape factor if permissible yield strees in compression and tension is 260 MPa and 290 N/mm² respectively. The section has following dimensions:

Top & Bottom flange = 200 mm × 25 mm

Web = 25 mm × 150 mm (excluding top flange) **[12]**

c) Explain elasto-plastic behaviour of a beam in flexure and find expression for moment of resistance. **[8]**

P.T.O.

Q2) a) A Portal frame ABCD is fixed at A & D. Columns AB & DC are 6m in height & beam BC is 5m long. Mp for beam is twice that for columns. It is subjected to factored udl of 25 kN/m over BC & horizontal factored concentranted load of 40 kN at B in the direction BC. Sketch all possible mechanisms & obtain design moment Mp. Draw statically admissible bending moment diagram. **[12]**

b) A continuous beam ABCD is simply supported at A,B,C & D. Span AB = 5m. BC 4m & CD = 6m. Mp is uniform. It is subjected to factored loads as under,

   i) Total udl value on AB & CD = W.

   ii) Concentrated load 2 W at center of BC.

   Find collapse load 'W' & draw statically admissible bending moment diagram. What is the type of collapse? **[13]**

Q3) A symmetrical gable portal frame ABCDE has bases A & E fixed 15 m apart. Vertical columns AB & ED each equal to 5 m & apex C is 10 m above base. It is subjected to horizontal load 35 kN at B & concentrated load of 70 kN each at centre of each gable beam. Mp is uniform. **[25]**

a) Draw all basic mechanisms and obtain Mp in each case.

b) Draw (sway + Gable) mechanism & obtain Mp

c) Draw free body diagram of beam & column.

SECTION - II

Q4) a) Classify symmetrical 'I' section having width of flange 280 mm & overall depth 350 mm. Thickness of section is 20 mm uniform. F_y = 280 MPa. If this section is used as a beam, find moment of resistance as per IS : 800-2007 codal provisions. **[15]**

b) How the cross sections are classified in Limit State Theory? What are their significance? **[5]**

c) Explain in brief philosophy of Limit state design. **[5]**

Q5) A column between floor of a multi-storey building frame is subjected to load and moment as mentioned below: **[25]**

Ultimate axial compression = 1100 kN

Ultimate moments about major axis:

At Top = 150 kN m

At Bottom = 70 kN m

The effective length of column is 5.5m.

It is braced at its mid-height to provide local lateral restraint for buckling about y-y axis. Design the section & use specifications for interaction between moment & axial compression

Q6) Design symmetrical gable portal frame for workshop shed of span 30m. Height of both columns is 12m and apex is at 15m from base. Column bases are fixed. AC sheet is used over purlins. Using (DL + LL) combination, design uniform section for bending as per IS:800-2007. **[25]**

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