Total No. of Questions : 6] SEAT No. :

P3756

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M.E. (Civil - Structures)

PLASTIC ANALYSIS & DESIGN OF STEEL STRUCTURES

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

Time : 4 Hours] *[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) ***Neat 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 elasto-plastic behaviour of a beam in flexure and find expression for moment of resistance. **[10]**

b) Explain step by step how-plastic hinge in beam develops under progressive loading. Draw various stages with stress diagrams. Taking angle section for above illustration finds its shape factor. Flange 100 × 10 mm, vertical leg 100 × 10 mm, Total depth 120 mm, $I_{zz} = 24.425 \times 10^5 mm^4$. **[15]**

Q2) a) A Rectangular Portal frame ABCD is fixed at A & D. Columns AB &DC are 5m in height &beam BC is 6m long. Mp for beam is twice that for columns. It is subjected to factored udl of 30kN/m over BC & horizontal factored concentrated load of 50 kN at B in the direction BC. Sketch all possible mechanisms & obtain design moment Mp. Draw statically admissible bending moment diagram. **[13]**

b) Find value of W at collapse for the continuous beam shown in Fig. 2 (b) &Draw bending moment diagram. **[12]**

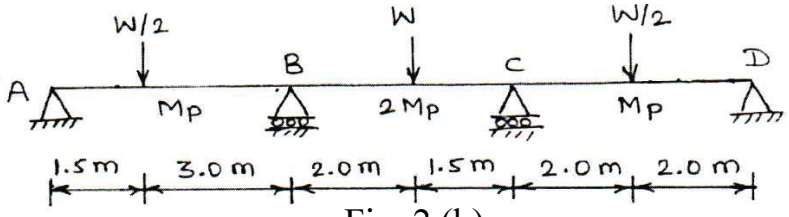

Fig. 2 (b)

P.T.O.

Q3) A symmetrical gable portal frame ABCDE has bases A & E fixed 16 m apart. Vertical columns AB & ED each equal to 5 m & apex C is 10 m above base. It is subjected to horizontal load 20 kN at B & concentrated load of 80 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 400 mm & overall depth 500 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. **[12]**

b) A simply supported beam has a span 6 m. If section used is ISLB 350. Find moment of resistance of the section in following two cases. **[13]**

1) Compression flange is laterally supported fully.

2) Compression flange is laterally restrained at both the ends and at Mid span only. Use F_y = 250 MPa.

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

Ultimate axial compression = 1200 kN

Ultimate moments about major axis:

AtTop = 160 kN.m

At Bottom = 80 kN.m

The effective length of column is 5.0 m.

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) In a rectangular portal frame, a corner connection is to be designed. Bending moment at knee is 220 kN.m. If designed section for beam & column both is ISMB 400. Design &Draw details at knee portion F_y = 280 MPa. Apply all checks & provide diagonal stiffener if required any. **[25]**