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10CV72

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Design of Steel Structures

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of IS-800-2007 permitted.***
3. ***Use of steel tables permitted.***

PART – A

1 a. Define characteristic strength of steel and how is it determined. **(06 Marks)**

b. Find out the service load on interior column BC on 2nd floor and AB on first floor of a seven storey building as shown in Fig. Q1 (b). **(06 Marks)**

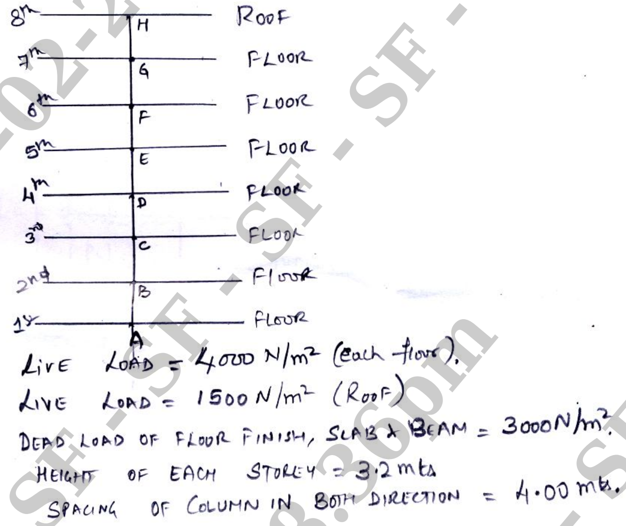

Fig. Q1 (b)

c. Distinguish between the deterministic and probabilistic structural design methods. **(08 Marks)**

2 a. With neat sketches show the failure modes of bolted joints. **(06 Marks)**

b. Explain the factors which reduce the shear capacity of bolted joints. **(06 Marks)**

c. Determine the shear capacity of bolts used in connecting two plates as shown in Fig. Q2 (c), if

(i) Slip resistance in designated at service load.

(ii) Slip resistance in designated at ultimate load.

Given : HSFG bolts of grade 8.8 are used in clearance holes coefficient of friction = 0.3. **(08 Marks)**

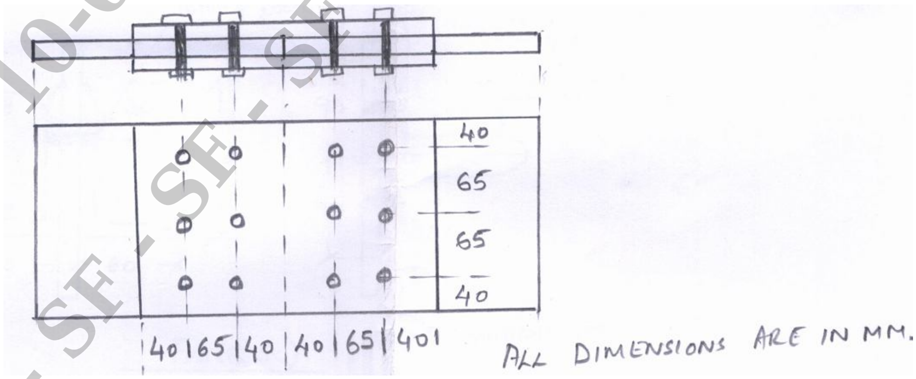

Fig. Q2 (c)

3 a. State advantages of welded joints versus bolted joints. **(06 Marks)**

b. The 10 mm thick bracket plate shown in Fig. Q3 (b) is connected with the flange of column ISHB 300@ 577 N/m. Find the size of the weld to transmit a factored load of 250 kN. **(14 Marks)**

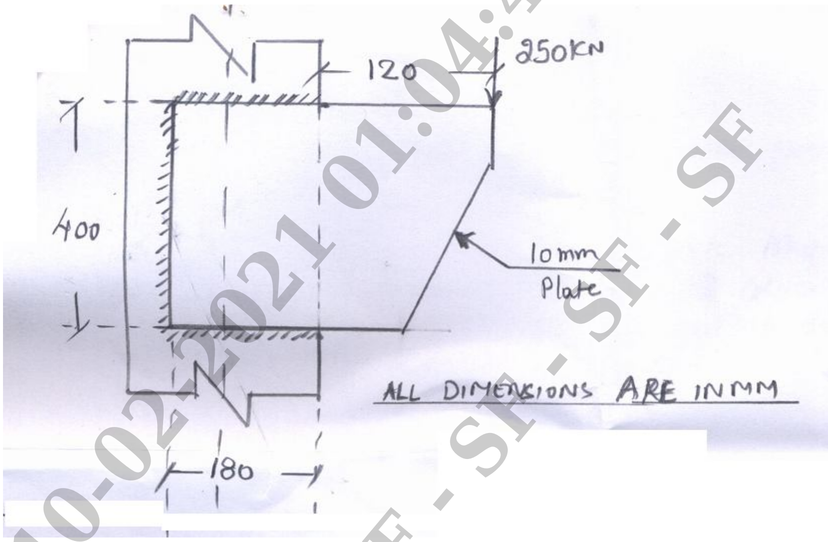

Fig. Q3 (b)

4 a. Define (i) Plastic hinge (ii) Mechanism. **(06 Marks)**

b. Explain the conditions to be satisfied for the plastic methods of analysis. **(06 Marks)**

c. A fixed beam is subjected to a load 'W' as shown in the Fig. Q4 (c). Estimate the collapse load. **(08 Marks)**

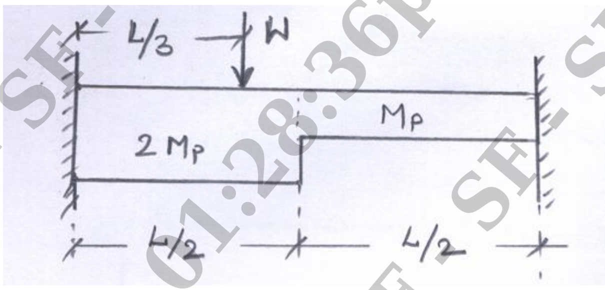

Fig. Q4 (c)

PART – B

5 a. Explain the different types of failures in a tension member. **(06 Marks)**

b. Determine the block shear strength of the welded tension member shown in Fig.Q5 (b). Steel is of grade Fe410. **(06 Marks)**

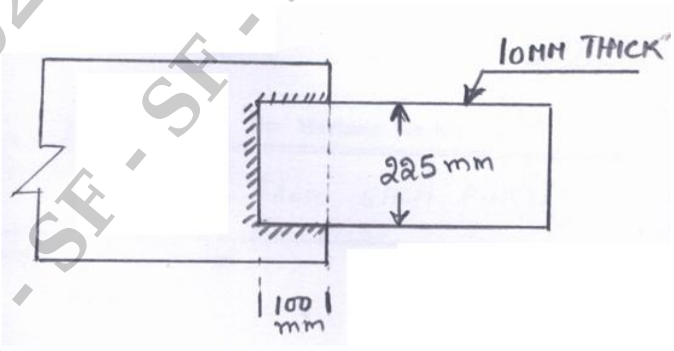

Fig. Q5 (b)

5 c. Determine the tensile capacity of the section shown in Fig. Q5 (c)., if
   (i) Angles are placed on the opposite side of the gusset plate (tack bolted)
   (ii) Angles are placed on the same side of gusset plate (tack bolted)
   (iii) Angles are not tack bolted. **(08 Marks)**

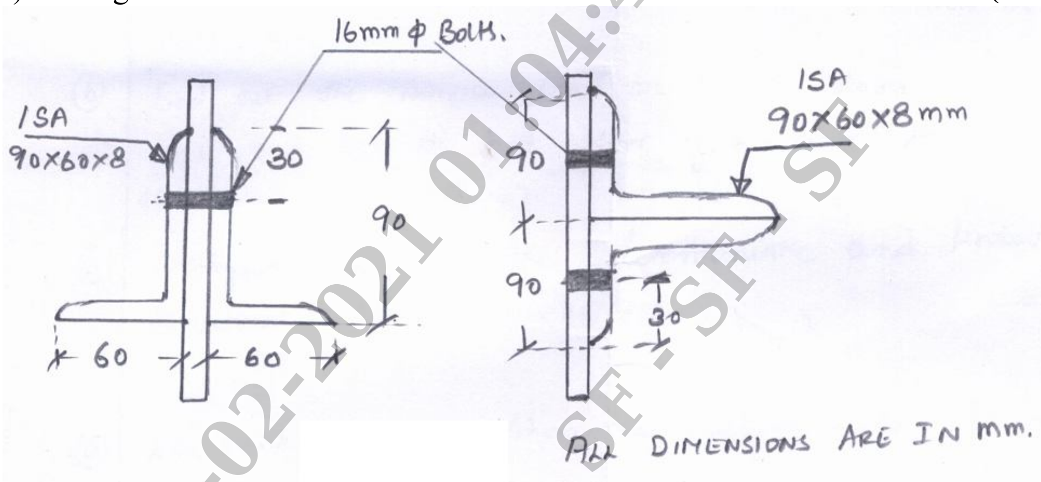

Fig. Q5 (c)

6 a. What are the ways on axially loaded compression member can buckle, when it becomes unstable overall. **(03 Marks)**
   b. Distinguish between column and strut. **(03 Marks)**
   c. Design a single angle discontinuous strut to carry a factored axial compressive load of 65 kN. The length of a strut is 3.0 m between intersections. It is connected to 12 mm thick gusset plate by 20 mm diameter 4.6 grade bolts. Use steel of grade Fe410. **(14 Marks)**

7 a. What are column bases and what are they primarily designed for? **(06 Marks)**
   b. Design a slab base for a column ISHB 350 @ 710 N/m subjected to an factored axial compressive load of 1500 kN for the following conditions:
   (i) Load is transferred to the base plate by direct bearing of column flanges.
   (ii) Load is transferred to the base plate by welded connections; the column end and the base plate are not machined for bearing.
   The base rests on concrete pedestal of grade M20. **(14 Marks)**

8 Design a steel beam section for supporting roof of a big hall for the following data and apply the usual checks. Assume Fe410 grade of steel.
Clear span : 6.5 m
End bearings : 150 mm
C/C spacing of beams : 3 m
Imposed load on the beam : 10 kN/m^2
Dead load (inclusive of self weight) : 4 kN/m^2
Restriction on beam depth : 375 mm
The compression flange of the beam in laterally supported throughout. **(20 Marks)**

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