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B TECH

(SEM-VII) THEORY EXAMINATION 2018-19
DESIGN OF STEEL STRUCTURES

Time: 3 Hours

Total Marks:100

- Note:** 1. Attempt all Sections. If require any missing data; then choose suitably.
 2. IS 800:2007 original copy is allowed. Use of steel table is allowed.
 3. Assume any missing data suitably if required.

SECTION A

1. Attempt all questions in brief :

2 X 10 = 20

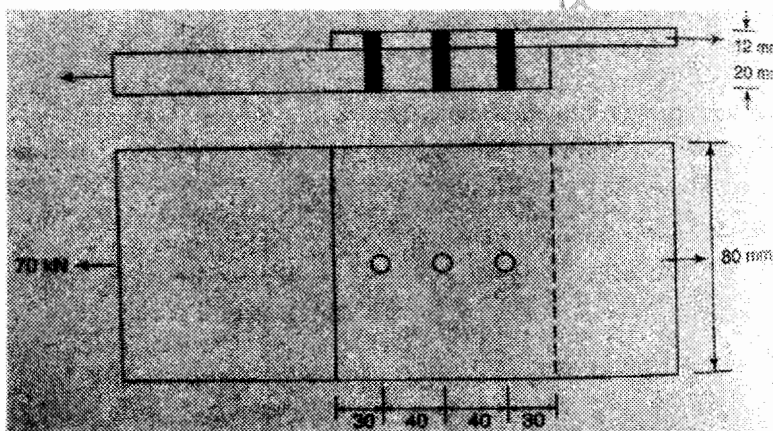
- Distinguish between: factor of safety and partial safety factor.
- List the disadvantages of steel as a structural material.
- What does 4 and 6 imply for bolts of grade 4.6.
- Why fillet welds are preferred over butt welds.
- What is shear lag effect?
- What is lug angle.
- What do you understand by inelastic buckling?
- Define effective length of column.
- Why is an I- section commonly used as a beam member even though its lateral buckling strength is low?
- What is the main purpose of a gantry girder?

SECTION B

2. Attempt any three of the following:

10 X 3 = 30

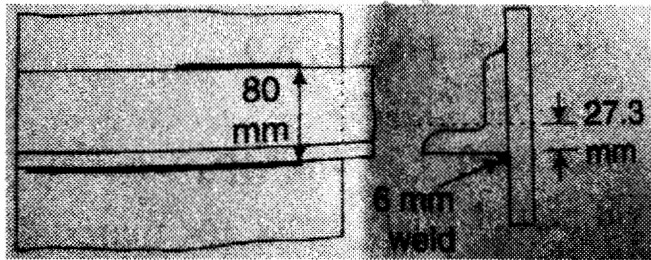
- Draw a stress strain curve for mild steel and discuss salient points on it.
- Design a lap joint between two plates as shown in fig below so as to transmit a factored load of 70 kN using M16 bolts of grade 4.6 and grade 410 plates.



- c) Select a suitable angle section to carry a factored tensile force of 170 kN assuming a single row of M20 bolts and assuming design strength as $f_y = 250 \text{ N/mm}^2$.
- d) Design a column to support a factored load of 1050 kN. The column has an effective length of 7.0 m with respect to Z-axis and 5.0 m with respect to y-axis. Use steel of grade Fe 410.
- e) Design a simply supported beam of span 5m carrying a reinforced concrete floor capable of providing lateral restraint to the top compression flange. The uniformly distributed load is made up of 20 kN/m imposed load and 20 kN/m dead load (section is stiff against bearing). Assume Fe 410 grade steel.

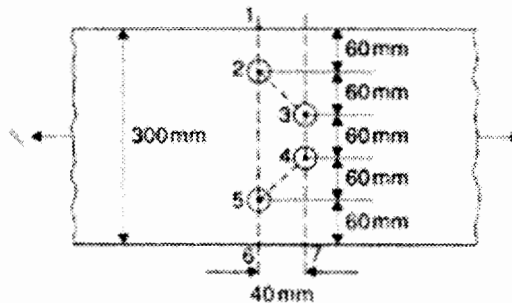
SECTION C

3. **Attempt any one part of the following:** **10 X 1 = 10**
- a) List various loads that may act on steel structures. Describe the environmental load briefly.
 - b) Distinguish between the working stress methods, ultimate strength design and limit state design.
4. **Attempt any one part of the following:** **10 X 1 = 10**
- a) A tie member consisting of an ISA 80mm X 50mm X 8 mm (Fe 410 grade steel) is welded to a 12 mm thick gusset plate at site. Design welds to transmit load equal to the design strength of the member.

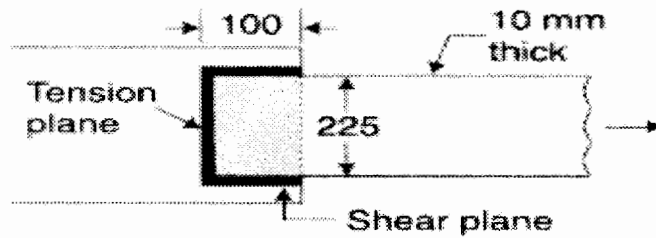


- b) Two plates 10-mm and 18-mm thick are to be joined by a double cover butt joint. Assuming cover plates of 8-mm thickness. Design the joint to transmit a factored load of 500 kN. Assume Fe415 plate and grade 4.6 bolt.

5. **Attempt any one part of the following:** **10 X 1 = 10**
- a) Determine the minimum net area of cross section of 300 X 12 mm as shown in figure below. The holes are of diameter 17.5 mm.
Pitch (p) = 40 mm Gauge (g) = 60 mm



- b) Determine the block shear strength of the welded tension member shown below .grade of steel is Fe 410.



6. **Attempt any one part of the following:**

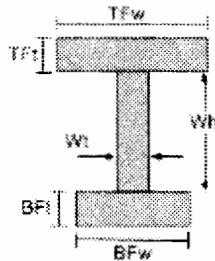
10 X 1 = 10

- Calculate the design compressive load for a column made up of ISHB 350@710.2 N/m and 3.5 m high.The column is restrained in direction and position at both the ends. Use steel of grade Fe-410.
- Design a slab base for a column ISHB 350 @ 710.2 N/m subjected to a factored axial load of 1500 kN.The column end and base is machined and grade of concrete used is M-20.

7. **Attempt any one part of the following:**

10 X 1 = 10

- A simply supported steel joist of 4.0 m effective span is laterally supported throughout .it carries a total uniformly distributed load of 40 kN (inclusive self-weight).design an appropriate section using steel of grade Fe 410.
- Determine the plastic moment capacity and plastic modulus of section of the unsymmetric section shown below



TFw=100mm, TFt=10mm, BFw=200mm, BFt=10mm, Wh=180mm, Wt=10mm All dimensions are in mm.