

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S25 – QUESTION BANK

Subject Name & Code:

Design of Steel Structures- 3170618

Unit 1: Introductions (Loads, Load Combinations, and Connections)

Repeated Questions:

1. **Enlist various types of loads to be considered in the design of a steel structure.**
 - Appeared in: W23 (Q1a, 03 marks), S24 (Q1b, 03 marks), W24 (Q1a, 03 marks)
2. **In what sense are the forces due to wind and those produced by an earthquake on a structure different?**
 - Appeared in: S22 (Q1a, 03 marks), S25 (Q1b, 04 marks)
3. **Explain/Design an unstiffened seat angle connection.**
 - Appeared in: W23 (Q1c, 07 marks), S23 (Q1c, 07 marks), S24 (Q1c, 07 marks), W24 (Q2c, 07 marks)
4. **Explain the following connections with neat sketches: beam-to-beam web angle connection, beam-to-column flange seat angle connection.**
 - Appeared in: W22 (Q3b, 04 marks), S22 (Q5b, 04 marks), S25 (Q5b, 04 marks)
5. **Derive the resultant force in a Bolted Bracket Connection Type II with neat sketches.**
 - Appeared in: S22 (Q1b, 04 marks), S25 (Q1c, 07 marks)

Other Important Questions:

1. **Explain the light moment connection.** (W22 - Q1a, 03 marks)
2. **Explain Lateral load due to Wind and Seismic as per I.S. Standard.** (W22 - Q1b, 04 marks)
3. **What are risk coefficient, terrain factor, and topography factor?** (S22 - Q5a, 03 marks)
4. **What are the advantages and disadvantages of steel as a structural material? / Enlist the advantages and disadvantages of steel structures.** (S25 - Q1a, 03 marks), (W22 - Q3a, 03 marks), (W24 - Q3a, 03 marks), (S24 - Q1a, 03 marks)
5. **Express the relation between basic wind speed and design wind speed. Briefly discuss various factors to be considered to obtain design wind speed.** (W24 - Q1b, 04 marks), (S23 - Q1b, 04 marks)
6. **Based on rigidity, classify various types of connections. Illustrate moment vs rotation behavior of each type with a sketch.** (S23 - Q2b, 04 marks)
7. **Differentiate between flexible and rigid connections with a sketch.** (S24 - Q2b, 03 marks)

8. **Discuss various load combinations recommended in IS: 800 - 2007 for estimating design load on steel structures.** (S23 - Q3b, 04 marks)
9. **What are external and internal wind pressure coefficients? Give codal provision for internal wind pressure coefficient for a building.** (S22 - Q3a, 03 marks)
10. **A beam ISLB 300 is connected to a flange of column ISHB 300 to transmit an end reaction of 150 kN due to factored loads. Design web angle connection using M 20 bolts of 4.6 grade and steel Fe 415.** (W22 - Q1c, 07 marks) *[Numerical]*
11. **Calculate the design wind pressure and design forces on a hoarding 10 m long and 5m high, to be fixed at the roof of a 24m high building...** (S22 - Q1c, 07 marks), (S25 - Q5c, 07 marks) *[Numerical]*
12. **Design a bolted bracket connection to support an end reaction of 400 kN because of the factored loads...** (S25 - Q3c, 07 marks) *[Numerical]*
13. **Determine the safe load P that can be carried by the joint shown in Fig. 4. The bolts used are 20 mm diameter of grade 4.6...** (S22 - Q3c, 07 marks) *[Numerical]*
14. **A beam ISMB 300 is connected to the flange of a column ISHB 350... Design fillet weld for a double angle framed connection.** (S23 - Q2c OR, 07 marks) *[Numerical]*
15. **A beam ISMB 250 is connected to the flange of a column ISHB 250... Design weld for a double angle framed connection.** (S24 - Q2c, 07 marks) *[Numerical]*

Unit 2: Design of Plate Girder

Repeated Questions:

1. **Explain the design procedure of a Plate Girder.**
 - Appeared in: S22 (Q3b, 04 marks), S25 (Q2b, 04 marks)
2. **What is tension field action? Explain with a neat sketch: Tension field method for finding nominal shear strength of a web. / Describe tension field method used for computing shear buckling strength of web plate.**
 - Appeared in: W23 (Q2b, 04 marks), S23 (Q4b, 04 marks), S24 (Q4b, 04 marks)
3. **Explain simple post critical method to evaluate shear strength of web of plate girder.**
 - Appeared in: S22 (Q5b, 04 marks), S24 (Q3b OR, 04 marks), S25 (Q5b, 04 marks), W24 (Q5b, 04 marks)
4. **Explain various types of stiffeners used in a plate girder with their purpose. / Discuss various types of stiffeners provided in plate girder, with their specific purpose.**
 - Appeared in: S23 (Q3a, 03 marks), S24 (Q3a, 03 marks)
5. **Design a welded plate girder for a given span and loading.**
 - Appeared in: S22 (Q4c, 07 marks), S25 (Q4b, 07 marks), W23 (Q2c, 07 marks), S23 (Q2c, 07 marks), S24 (Q2c OR, 07 marks), W24 (Q4a, 07 marks)

Other Important Questions:

1. **How would you generalize the plate girder? Explain the advantages and disadvantages of it.** (W22 - Q2a, 03 marks)
2. **Differentiate between plate girder and Beam.** (W23 - Q2a, 03 marks)
3. **What is the difference between a beam and a plate girder? Why are end posts required in plate girders?** (S25 - Q4a, 04 marks)
4. **Explain pre-buckling and post-buckling behavior of the web plate.** (W22 - Q2b, 04 marks)
5. **What is diagonal tension field theory? How does pure tension field concept differ from incomplete tension field in plate girders?** (S22 - Q3b, 04 marks)
6. **Enlist various elements of plate girder and Draw neat sketch of transversely and longitudinally stiffened plate girder. / Draw neat sketch of fully stiffened welded plate girder with all the elements.** (W23 - Q3b, 04 marks), (W24 - Q3b, 04 marks)
7. **Write advantages and disadvantages of plate girder compared to truss girder.** (S23 - Q2a, 03 marks), (S24 - Q4a, 03 marks)
8. **Describe various criteria for minimum web thickness requirements of plate girder based on serviceability, recommended by IS: 800 – 2007.** (S23 - Q3b OR, 04 marks), (S24 - Q3b, 04 marks)
9. **Give name of any four elements of plate girder with their function.** (S23 - Q4b OR, 04 marks)
10. **Under what circumstances are vertical and horizontal stiffeners provided?** (S25 - Q3b OR, 04 marks)
11. **A simply supported welded plate girder of span 35 m that is subjected to a service load of 60 kN/m UDL and two fixed point loads of 350 kN each... Design the plate girder...** (W22 - Q2c, 07 marks) [Numerical]
12. **Design a welded plate girder with a clear span of 16 m simply supported at the ends...** (W22 - Q2c OR, 07 marks) [Numerical]
13. **The following data refers to a welded plate girder of span 21 m... find out (1) SF & BM, (2) Size of web, (3) Size of Flange, (4) Check for moment capacity, (5) Shear**

- resistance.** (W23 - Q2c, 07 marks) *[Numerical]*
14. **Design a section for bolted plate girder for an effective span of 24 m...** (W23 - Q2c OR, 07 marks) *[Numerical]*
 15. **A welded plate girder consisting web plate of size 1600 mm deep x 8 mm thick... check for buckling of typical stiffener using simple post critical method.** (S23 - Q3c, 07 marks) *[Numerical]*
 16. **Design a vertical stiffener under concentrated load for Q.4(a).** (W24 - Q4b, 07 marks) *[Numerical]*

Unit 3: Design of Foot-Over Bridge

Repeated Questions:

1. **What is a footbridge? / What is the meaning of foot over bridge? Write where it is useful.**
 - Appeared in: W22 (Q3a, 03 marks), W23 (Q4a, 03 marks)
2. **What is the popular geometry of the foot bridge?**
 - Appeared in: W22 (Q3b, 04 marks)
3. **Enlist various components of a foot over bridge.**
 - Appeared in: W24 (Q5a, 03 marks), S23 (Q4a, 03 marks), S24 (Q5a, 03 marks)
4. **Design a cross beam for a steel foot over bridge.**
 - Appeared in: W23 (Q4b, 04 marks), S23 (Q3c, 07 marks), S24 (Q3c, 07 marks), W24 (Q5a, 07 marks), S25 (Q5c, 07 marks)
5. **Design top chord / bottom chord members for a foot over bridge.**
 - Appeared in: W23 (Q4c, 07 marks), S23 (Q4c, 07 marks), W24 (Q5b, 07 marks)

Other Important Questions:

1. **Differentiate between deck and through type truss bridge. / Differentiate between deck type and through type truss bridge. Also draw sketch for both type of truss bridges.** (W23 - Q4a OR, 03 marks), (S23 - Q3a OR, 03 marks)
2. **Enlist various types of trusses used for truss girders.** (W23 - Q3b OR, 04 marks), (S25 - Q2a, 03 marks)
3. **Enlist common type of trusses with sketch, used as a truss girder in foot over bridge.** (S24 - Q3a OR, 03 marks)
4. **Enlist various forces to be considered in design of foot over bridge.** (S24 - Q4a, 03 marks)
5. **Write any three situations, where truss girder is preferred over plate girder.** (S23 - Q4a OR, 03 marks)
6. **Fill blank spaces... In through type bridge with N – type truss girder: (i) Top chord members are subjected to force...** (S23 - Q5a, 03 marks)
7. **Design a steel foot-over bridge for the following... Span Of bridge = 18 m... Types of girder N-type truss.** (W22 - Q3c, 07 marks) [Numerical]
8. **A foot over bridge is of span 24 m and a pedestrian load of 4 kN/m²... design & detail a cross beam and a top chord near the center.** (W22 - Q3c OR, 07 marks) [Numerical]
9. **Analysis a steel foot bridge for the following data: Type of truss: Pratt Span: 35 m...** (S22 - Q5c, 07 marks) [Numerical]
10. **Analysis a steel foot bridge for the following data: Type of truss: Pratt, Span: 30 m...** (W24 - Q5c, 07 marks) [Numerical]

Unit 4: Plastic Design

Repeated Questions:

1. **State/Explain the assumptions made in plastic design.**
 - Appeared in: W23 (Q5a, 03 marks), S23 (Q1a, 03 marks)
2. **What is a plastic hinge? At which points is a plastic hinge likely to form? / Explain the Plastic Hinge concept.**
 - Appeared in: W23 (Q5b, 04 marks), S22 (Q2c, 04 marks), W24 (Q3a, 07 marks)
3. **Explain/Distinguish between working stress method and plastic design method.**
 - Appeared in: W23 (Q5a, 03 marks)
4. **Write advantages and disadvantages of plastic design method.**
 - Appeared in: W23 (Q5b OR, 04 marks)
5. **Determine the collapse load / plastic moment capacity for a given beam or frame.**
 - Appeared in: S22 (Q2b, 04 marks), S22 (Q2c OR, 07 marks), W23 (Q5c, 07 marks), S23 (Q4c OR, 07 marks), S24 (Q4c, 07 marks), W24 (Q1c, 07 marks), W24 (Q2c OR, 07 marks), S25 (Q2c OR, 07 marks), S25 (Q4b OR, 10 marks)

Other Important Questions:

1. **Why is the plastic method of design more useful for redundant structures than the determinate structures?** (S22 - Q2a, 03 marks)
2. **Explain the load factor, shape factor and collapse load.** (S22 - Q4a, 03 marks)
3. **Explain plastic bending of a beam with terminology.** (W22 - Q4a, 03 marks)
4. **Explain the hinge length and assumptions made in plastic analysis in detail.** (W22 - Q4b, 04 marks)
5. **Explain the lower and upper bound theorem of plastic analysis.** (S25 - Q3a OR, 03 marks)
6. **Distinguish between static and Kinematic method of plastic analysis.** (S25 - Q5a OR, 03 marks)
7. **Find the shape factor for a given section. / Derive formula for shape factor of rectangular/circular section.** (W22 - Q4b, 04 marks), (W24 - Q2a, 03 marks), (S23 - Q5b, 04 marks), (S25 - Q2c, 07 marks)
8. **Distinguish between elastic modulus and plastic modulus.** (S25 - Q5a, 03 marks)
9. **A two-span continuous beam ABC has span length AB = 8m and BC = 6m... find the section modulus needed...** (W22 - Q4c, 07 marks) [Numerical]
10. **Determine the plastic moment capacity of ISMB 300 with top plate 200 mm x 20 mm.** (S23 - Q5c, 07 marks) [Numerical]
11. **Determine the plastic moment capacity about horizontal centroidal axis of ISMB 250 provided with 125 mm x 20 mm plates each at top and bottom of flange.** (S24 - Q5c, 07 marks) [Numerical]
12. **A continuous steel beam consists of three equal spans 6m each carries a u.d.l. of 75 kN/m... Using plastic method, design the beam...** (W23 - Q5c, 07 marks) [Numerical]

Unit 5: Design of Gantry Girder

Repeated Questions:

1. **What is the difference between a gantry girder and a plate girder?**
 - Appeared in: W22 (Q5a, 03 marks)
2. **Explain the design procedure steps for the Gantry girder. / Describe the design procedure for design of Gantry Girder?**
 - Appeared in: W22 (Q5b, 04 marks), S25 (Q3c OR, 07 marks)
3. **Enlist various loads acting on gantry girder and Write codal criteria for additional impact allowances for crane girders.**
 - Appeared in: W23 (Q3a OR, 03 marks)
4. **Design a gantry girder / Provide a suitable section for a gantry girder for given data.**
 - Appeared in: W22 (Q5c, 07 marks), W23 (Q3c, 07 marks), W23 (Q3c OR, 07 marks), S22 (Q4 OR, 14 marks), W24 (Q4a OR, 14 marks), S23 (Q5a, 07 marks), S24 (Q5 OR, 14 marks)

Other Important Questions:

1. **Draw a neat sketch showing the overhead crane system with a gantry girder and other important components.** (W22 - Q5a OR, 03 marks)
2. **Draw sketches for any two forms of Gantry girder.** (W22 - Q5b, 04 marks)
3. **Differentiate between surge load and drag load as applied to gantry girders carrying cranes.** (S22 - Q3a, 03 marks), (S25 - Q3b, 04 marks)
4. **A laterally unsupported gantry girder of span 6 m, supports an EOT crane of capacity 130 kN... Determine (i) maximum bending moment and maximum shear force...** (S23 - Q5a, 07 marks) [Numerical]
5. **A gantry girder is made from built up section of ISMB 500 and ISMC 250... Check for (i) class of section (ii) moment capacity... and (iii) shear capacity...** (S23 - Q5b OR, 07 marks) [Numerical]
